Railway Age

DAILY EDITION

FIRST HALF OF 1922—No. 10c CHICAGO—THURSDAY, MARCH 16, 1922—NEW YORK SIXTY-SEVENTH YEAR

Published weekly by Simmons-Boardman Pub. Co., Woolworth Bldg., New York, N. Y. Subscription Price U. S., Canada and Mexico, $6.00; foreign countries (excepting daily editions), $8.00; single copies, 25c. Entered as second-class matter, January 30, 1918, at the post office at New York, N. Y., under the act of March 3, 1879. Daily edition application made at the post office at Chicago, Ill., for entry as second class matter. Chicago office, Transportation Building.

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EDITORIAL

DAILY EDITION

Contents

The Engineer and Corrosion

It may reasonably be asserted that no phase of railroading has been the object of more "wishy-washy" thinking, or the recipient of more "bunk" passing under the guise of scientific observations than the subject of pitting and grooving in locomotive boilers, unless, of course, it is the subject of boiler waters in general, of which pitting and grooving is an element. And yet it is important that the railroads understand thoroughly the phenomenon of corrosion in order that they may exercise a control over its underlying causes and thereby avoid the very considerable losses which arise annually from it. In view of this it is highly gratifying to note not only that the subject of pitting and grooving has been assigned for study to a special committee of the American Railway Engineering Association but also that definite progress has already been made. That is getting down to a proper appreciation of the subject and much of benefit should come of it. Contrary to the idea apparently entertained by some that pitting and grooving must remain a grievous trouble in the territories where it is encountered until some distinguished appearing individual appears on the scene with the solution of the problem in capsule form; pitting and grooving, while admittedly a baffling study and certainly a trouble not to be corrected by half-measures, is but a problem in science, which can be solved to the satisfaction of all concerned. It is properly a problem for the attention of the engineer, and the Water Service committee in devoting attention to its solution, may not only derive satisfaction in the realization of its opportunity to work a very material and tangible benefit to the railroads, but also in its opportunity to show those who are skeptical, that the engineer is no less competent in this field of science than he has proven himself in others.

Hotel Facilities Becoming Inadequate

The constant growth in the American Railway Engineering Association from year to year has been emphasized in a striking manner this year by the inability of the Congress hotel to provide rooms for all who desired them and by the insufficiency of the seating capacity during sessions of the convention in the Florentine room. It is not the fault of the Congress hotel that this is so, for the housing of the annual meeting of an organization such as the Engineering Association, with its 2,000 members, augmented by those participating in the exhibit at the Coliseum, is a big task. It is evident, however, that the Board of Direction of the association must give careful attention to the matter of hotel facilities in the very near future. One of the provisions of the original constitution fixes Chicago as the location for the annual meeting, and few things have contributed more to the success of the meetings and to the constructive work of the association. The association cannot consider another city as its place of meeting. It should be mentioned, in this connection, that the Congress hotel is planning to build an addition.

Substitute Highway Crossings

The report of the Committee on Signs, Fences and Crossings calls attention to one feature of the permanent way which has been the subject of considerable development work during the last three years, namely, the highway crossing. There has been a concerted endeavor to devise substitutes for the plank crossing which has been the accepted standard on American railways for so long. This movement is probably receiving its principal impetus from the gigantic campaign of highway construction now sweeping over this country, but higher costs of lumber and certain inherent disadvantages of the plank crossing are no doubt contributing factors. It is of interest to note in this connection that this subject has been given considerable attention by the Roadmasters' Association, that organization having received several committee reports bearing on this problem. The substitute crossings developed thus far may in general be divided into two classes—those comprising unit members capable of installation and removal in much the same manner as crossing planks, and the integral construction built in place over and around the cross ties so as to form

a fixed roadway which cannot be removed without more or less complete reconstruction. Judging from the reception which these two types of crossings have received from the roadmasters it would seem that the latter type has been considered with somewhat greater favor, objections arising from an inability to remove the crossing construction intact being answered by suggestions for securing a character of track construction that will insure reasonable security of surface and alinement within the limits of the crossing. The use of special length rails to avoid splices is one specific measure proposed in this connection. Obviously improvement in the character of roadway afforded the highway traffic is an important consideration and one to which the railway engineer must, of course, give reasonable consideration because of its influence on public relations. However, he must not lose sight of the fact that insofar as he is concerned the condition of the track structure is of first importance.

An Improvement in the Bulletins

Secretary Fritch is to be congratulated on the improved presentation of the committee reports in the bulletins issued in advance of this convention. Obviously, some introductory statements are necessary to outline the work completed or under way by the committee, but this has been reduced in most cases to a brief synopsis. There is still room for some improvement in the way of a more uniform presentation by the various committees, but this is a condition for which the secretary cannot very well be held responsible. There is a definite limit to the possibilities of editorial modification by the secretary after the report leaves the hands of the committee chairman. One consideration which should be taken well into account in the preparation of committee reports is the impression to be made on the non-member. To this end introductory matter must be placed in a form that is readily understood without a detailed knowledge of the workings of the association. The A. R. E. A. is fortunate in having adhered to a simple form of procedure for the submission of matter and its approval by the convention. Certain other technical societies have fallen into the unfortunate error of adopting a complex procedure entailing the use of a cryptic nomenclature which makes the process virtually inexplicable except to the thoroughly initiated. This procedure cannot but discourage interest on the part of the outsider and the A. R. E. A. is fortunate in having avoided it.

A Tribute to John F. Wallace

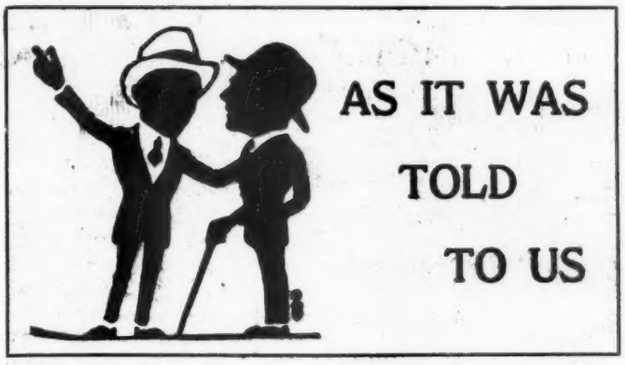
No greater tribute can be paid to the memory of John F. Wallace than to point to the American Railway Engineering Association as a creation of his far sighted vision. To Mr. Wallace belongs the credit for the suggestions leading to the organization of this association and it was largely under his guidance during the first years of its organization that the association established for itself the principles which have been so largely instrumental in keeping it on a true course of constructive work which is excelled by none and equalled by few technical associations. At the memorial meeting yesterday morning reference was made repeatedly to the principles which he enunciated during the formative years of the association, which have now become such established practice that they are accepted as a matter of fact, whereas in their inception they were pioneer in their character. The fixing in the constitution of a central location for the meeting, the elimination of all social features, the separation of the commercial from the technical and the placing of the proceedings upon a high plane have served as a pattern for many other organizations since that time. It is impossible to estimate the present influences of the association in railway engineering matters in North America or, in fact, in the entire world. To Mr. Wallace and also his associates of those early days all credit is due and it was fitting that this should be freely expressed yesterday morning.

"Fireproof" Buildings

Readers of Chicago papers were given their daily thrill yesterday at the expense of the Chicago, Burlington & Quincy, which suffered the loss of a modern office building and records and files, the value of which cannot be estimated at this time. The Burlington building was a modern "fireproof" structure in the sense in which that term is commonly understood—a steel frame protected against damage from fire by a covering of refractory material of accepted standards. Insofar as protection for the steel frame is concerned, there is reason to believe that the fireproofing functioned effectively. More than this cannot be said for it. The building stands, but everything in it not enclosed in vaults has been destroyed. On the sides of the building facing the interior of the block in which it stands, the windows were of wire glass set in hollow sheet metal sash. On the sides facing on Jackson boulevard and Clinton street, the windows were of ordinary glass with wooden frames. This difference in the window construction is in accordance with the provisions of the Chicago Building Ordinance and is founded on the supposition that exposure to fire in buildings across a street of ordinary width is much less than from a fire immediately adjacent. The fire on Tuesday night demonstrated that this is a rather fine-haired distinction. The conflagration in the block across the street from the railroad building was of such magnitude that the width of the city street afforded no protection. The windows were quickly destroyed and the fire swept into the interior. No doubt the temperatures prevailing, as in the case of other great American fires, was so high that even the best of window construction would not have availed. However, it might have served to have delayed the progress of the fire in the Burlington structure to an extent that would have reduced the total damage done. If all buildings in the city were of fireproof construction so that any fires originating in them would be restricted to the burning of the contents of the individual rooms, the volume of the fire and the temperature attained probably would not be sufficient to communicate with buildings separated by the width of a street. But unfortunately, a great many highly combustible buildings are still in use today and consequently many so-called "fireproof" buildings are exposed to fire hazards against which they are not adequately protected. One lesson to be drawn from this is the greater use of more effectively protected window openings, but the real lesson lies in the elimination of combustible buildings which comprise a menace against which no building no matter how well constructed may be assumed to be fireproof.

Union Train Control on the Pennsylvania

The Pennsylvania has arranged with the Union Switch & Signal Company, Swissvale, Pa., for an installation of the Union full speed train control system on 49 miles of line between Lewistown and Sunbury, Pa.



Among the railway systems with large attendance at this convention, the Grand Trunk has, so far as known, taken the lead with 41 representatives.

* * *

George T. Stewart, chief engineer of the Cuba Railway, with headquarters at Camaguey, Cuba, registered at the convention at the Congress hotel Tuesday morning.

* * *

The Interstate Commerce Commission announced yesterday that the first of a series of hearings on its tentative consolidation plan will begin at Washington on April 24 before Commissioner Hall, with particular reference to the Southeastern region.

* * *

Lieutenant Colonel W. B. Causey, U. S. R., technical adviser to Austria, with headquarters at Vienna, registered yesterday. Colonel Causey has long been an interested attendant at the conventions of the Engineering Association.

* * *

William D. Pence, for eight years a member of the Engineering Board, Bureau of Valuation, Interstate Commerce Commission, and prior to that time engineer for the Wisconsin Railroad and Tax Commissions for seven years, has returned to practice as a consulting engineer with office at 108 South Dearborn street.

* * *

In spite of the remoteness of the headquarters of the Gulf, Colorado & Santa Fe, which are at Galveston, Tex., the engineering department of that road is well represented at the convention. F. Merritt, chief engineer, is here accompanied by J. L. Starkie, office engineer; K. B. Duncan, district engineer, and E. Hanson, signal engineer.

Excursion Plan Completed

Word has been received from the Universal Portland Cement Company that a sufficient number of railway men have signified their intention of taking the trip to Buffington to warrant arrangements for a special train. This train will leave the La Salle Street Station over the New York Central at 10 a. m. Friday.

Today's Program

The program for the American Railway Engineering Association today is as follows:

VIII.	Masonry	Bulletin 242
IV.	Rail	Bulletin 243
VII.	Wooden Bridges and Trestles	Bulletin 243
XXI.	Economics of Railway Operation	Bulletin 243
VI.	Buildings	Bulletin 245
XVII.	Wood Preservation	Bulletin 245
XII.	Rules and Organization	Bulletin 245

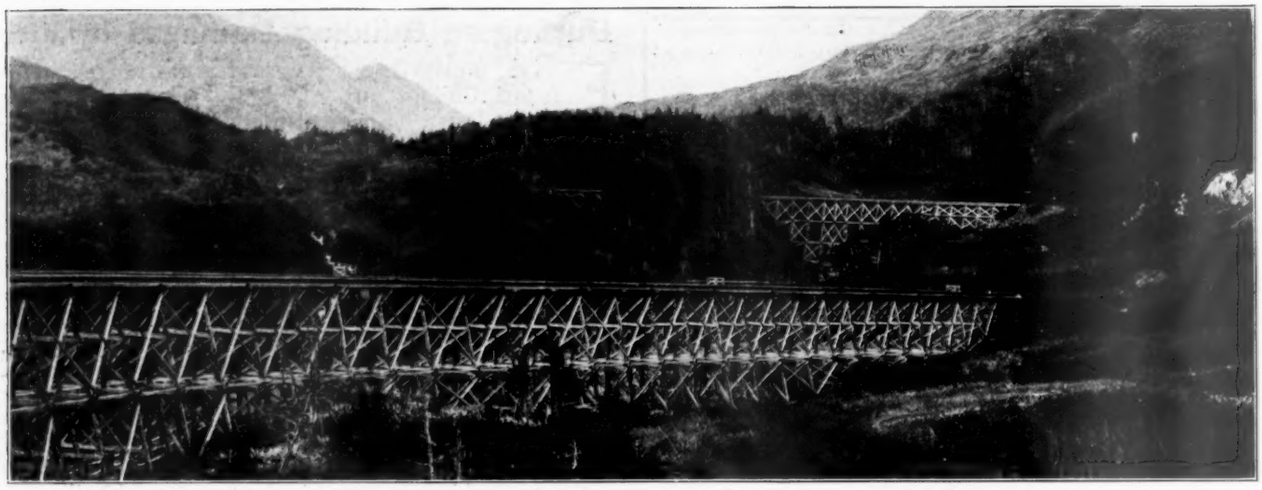
New Business.
Election and Installation.
Adjournment.

Burlington Building Damaged by Fire

FLAMES, WHICH FOR A TIME, threatened to repeat the famed Chicago fire of 1871, swept through the Union Depot business district of that city early yesterday morning and badly damaged in part the 15-story office building of the Chicago, Burlington & Quincy. The fire supposedly started at one o'clock in the morning in a building at 521 W. Jackson boulevard, just a few doors east of Clinton street and the Burlington headquarters, which are located at 547 W. Jackson boulevard. The flames spread with astounding rapidity among the neighboring buildings, which was due perhaps to a large quantity of oils and paints stored within several of the burning structures. The intense heat and blaze are first believed to have attacked the Burlington building at the thirteenth floor from which it soon spread to the two floors above, and five below. The city fire equipment was only capable of reaching as high as the eighth floor with water (this to be noted in the accompanying illustration), and while the lower part of the building remains practically untouched from the fire, this accounts for but a skeleton form supporting the upper seven floors. Windows on all of the top floors were blown out, with many likewise on the lower stories, especially on the Clinton street side and the rear of the building. Officers of the road were informed of the fire within a short time after the general alarm was turned in, and many were soon on the scene of activity.

Interior of the Burlington Office Building Burning During the Fire Early Tuesday Morning

Meetings were held throughout yesterday at temporary headquarters installed in the Otis Elevator building, one block west of the Burlington offices. It was decided then that if building inspectors would permit the company to use the first seven floors, steps would be taken immediately to utilize that space for all departments but the traffic, which has already been transferred to the old general office building. It is believed that many important papers, valuation records, engineering plans, and other valuable documents, some of which have been many years in the process of making, are destroyed, though it has been stated that some may be replaced from like copies on file with the Interstate Commerce Commission.



On the Famous Loop, Alaskan Railway.

Railway Engineering Association Proceedings

An Account of Wednesday's Sessions, Including the Presentation of Nine Committee Reports With Discussions

THE SECOND DAY'S SESSIONS of the convention of the American Railway Engineering Association was called to order promptly at 9 o'clock by President Downs. In spite of the early hour the room was well filled and every seat was taken within a short time. A special feature of the program was the setting aside of an hour at the close of the morning session for a memorial meeting for John F. Wallace, one of the founders and the first president of the association, and Colonel George H. Webb, a member of the Board of Direction, both of whom died during the year. Reports were presented by the committees on Track; Shops and Locomotive Terminals; Roadway; Economics of Railway Location; Electricity; Records and Accounts; Signs, Fences and Crossings; Water Service and Uniform General Contract Forms.

Association Pays Tribute to John F. Wallace and Geo. H. Webb

SHORTLY BEFORE THE CLOSE of the morning session yesterday, the American Railway Engineering Association paused in its deliberations for a few minutes to pay tribute to the memory of John F. Wallace, one of the organizers and the first president of the association, and to Colonel George H. Webb, a member of the Board of Direction. In referring to Mr. Wallace, L. A. Downs, president, said:

"I consider it a great personal privilege to preside this morning. I regarded Mr. Wallace as a father, and those of you who were present at the annual dinner last year will recall that he spoke of me as one of his boys. He started, like most of us, as a rodman on a railroad out west, and came to the Illinois Central as chief engineer, where I first knew him. He advanced step by step after he left the road, and he went to Virginia, taking me with him. He remained there only a few months when he came back as assistant to the second vice-president and finally was made general manager of the Illinois Central.

"He was then appointed by the President of the United States as one of the Canal Commissioners, and was later made its first chief engineer. An unusual thing happened on his resignation as chief engineer of the Panama Canal, for he was publicly rebuked by the then secretary of war, a man who afterwards became President of the United States and is now Chief Justice. It was an unwarranted and uncalled-for action.

"I had occasion to visit the Panama canal while it was building, and found that the plans originally made by Mr. Wallace were carried out to their completion. All honor to Col. Goethals for completing the Panama canal, but let us not forget the man who made the plans that were carried out. Robert Emmet said when he was condemned to die: 'Let no man dare, when I am dead, to charge me with dishonor. Let no man taint my memory by believing that I could have engaged in any cause other than that of my country's liberty and independence. Let not my epitaph be written until my country takes her place among the nations of the earth. Then, and not until then, let my epitaph be written.' I say—let not the epitaph of John F. Wallace be written until a committee of engineers, unbiased by politics, decide whose brains it was that built the Panama canal.

"Mr. Wallace returned from the canal broken in health. I visited him quite often at his home, and when he recovered he became president of Westinghouse, Church, Kerr & Co., afterwards becoming a consulting engineer. He was one of the few engineers who capitalized his brains and reaped a satisfactory dividend from it. He died in the harness on July 4, 1921, when he was in Washington to testify before the Interstate Commerce Commission. I admired Mr. Wallace as an engineer. I esteemed him as a superior officer on the railroad where I worked, and I loved him as a man."

Further tributes were made to Mr. Wallace by Hunter McDonald, Charles S. Churchill, W. C. Cushing, A. S. Baldwin, C. F. Loweth, C. A. Morse, T. L. Condron, J. L. Campbell, G. J. Ray, E. H. Lee, Edwin F. Wendt and W. M. Camp.

Following the conclusion of the tributes to Mr. Wallace, A. S. Baldwin referred to the death of Colonel Webb, in which he said in part:

"He was a very fine character and a very able man. I have never dealt with a man whom I believed to be fairer or more straightforward in his dealings than was Colonel Webb. At the call of his country he entered the service of the United States and served in Europe for the entire period of the war, returning to this country after serving with distinction as a colonel of the United States Army."

Further tributes were paid to Colonel Webb by S. E. Emmons, W. E. Biggs, G. A. Mountain, J. F. Deimling and E. T. Howson.

Report of the Committee on Track

Supplementing the specifications for frogs, switches, crossings, and guard rails adopted last year, specifications covering the general conditions and imperfections of manganese steel track castings are submitted for insertion in the Manual, in addition a few other recommended revisions and additions. A number of typical plans of turnouts, crossovers, etc., were submitted for adoption, while a few were submitted for information only. After collaborating with the Committee on Ballast, plans for a number of track tools were recommended. No definite conclusions have been arrived at in regard to the effect of brine drippings on tie plates or the canting of rail.

W. P. Wiltsee
Chairman

W. P. Wiltsee is completing his fourth year as chairman and his sixth year as a member of the Track Committee. He also served the Roadmasters and Maintenance of Way Association as president last year, while he is now a member of the American Railway Association's Committee on Train Control. Mr. Wiltsee is principal assistant engineer of the Norfolk & Western. As chairman of the Track Committee he has been particularly successful in enlisting the co-operation of the manufacturers of special track work in the preparation of standard designs for frogs, switches and crossings, which will be satisfactory alike to the builder and the user.

1. THE COMMITTEE recommended that the additions to the Manual as submitted in Appendix A be approved.

Conclusions

1. The committee recommended that the additions to the Manual as submitted in Appendix A be approved.

2. The committee recommended certain plans for adoption and others to be received as information. Appendix B also covers a progress report on uncompleted work, and reassignment of the subject is requested.

3. The committee recommended that the plans submitted be adopted and that the subject be reassigned, that the preparation of specifications which could not be completed may be continued.

4. The committee recommended that the specifications submitted be adopted, and the committee be authorized to continue its work on this topic.

5. The committee recommended one plan for adoption and another to be received as information, and submitted a list of certain A. R. A. signal section plans, which it recommended for endorsement by the association, and a progress report to be received as information. The committee recommended that this subject be continued.

6. The tables submitted in Appendix A, Item III, and explanatory report in Appendix F completes the work of this sub-committee. The committee recommended that this subject be discontinued.

7. The committee recommended that the progress reports in Appendix G and Appendix H be accepted as information and that the subject be continued.

Committee: W. P. Wiltsee (N. & W.), chairman; J. V. Neubert (N. Y. C.), vice-chairman; L. B. Allen (C. & O.), V. Angerer (Wm. Wharton, Jr., & Co.), J. B. Baker (Penna.), R. A. Baldwin (C. N. R.), C. W. Breed (C. B. & Q.), G. H. Bremner, H. G. Clark (C. R. I. & P.), E. A. Hadley (M. P.), G. W. Hegel (C. S.), E. T. Howson (*Railway Age*), T. T. Irving (G. T.), H. A. Lloyd (Erie), J. deN. Macomb (A. T. & S. F.), W. S. McFetridge (B. & L. E.), F. H. McGuigan, Jr. (U. S. R. A.), J. B. Myers (B. & O.), F. L. Nicholson (N. S.), J. H. Reinholdt (M. & St. L.), G. J. Slibeck (Pettibone-Mulliken), J. B. Strong (Ramapo Iron Works), J. R. Watt (L. & N.).

Appendix A—Revision of the Manual

The committee recommended the following supplement to the Specifications for Switches, Frogs, Crossings and Guard Rails, adopted March, 1921:

MANGANESE STEEL TRACK CASTINGS

1. General Conditions.—Castings shall be reasonably smooth and true to pattern in accordance with good foundry practice. Large lumps, sharp fins, sand and chills on the outside of castings shall be removed. The castings shall be free from such blow holes, sand holes, cracks, cold shuts and other defects which would impair their serviceability and as further specified below. Castings must be out of twist and reasonably true, both as to general surface and alinement, and must not show any signs of straining or undue denting produced in the straightening process.

The bottom part of castings which rest on ties shall be reasonably straight and out of twist, and shall be free from lumps or such imperfections as would prevent a good bearing.

2. Imperfections.—Tread surfaces within 2½ in. of gage line and side of groove I in. down from tread shall be free from physical defects, such as shrinkage cracks, sand holes, blow holes, cold shuts or segregation of metal, unless such defects are so small that they have been practically removed by the finish grinding, and there must be no indication of unsoundness of the metal. Shrinkage cracks, cold shuts or segregation of metal will not be allowed in any part of the tread surfaces. Sand holes, blow holes, and cold shuts in portions of the casting where they will not appreciably weaken the casting, or impair its wearing qualities, will be permitted. Castings must be free from shrinkage cracks running vertically in web members of solid work or horizontally at or near the ends or in corners of junction of projecting members or longitudinally in grooves. Other small shrinkage cracks which do not materially weaken the casting will be acceptable.

ITEM II

The committee recommended that plan No. 252, dated November, 1921, and titled "Details of Lamp Tips for Switch Stands," be adopted, and that Section 12 of "Requisites for Switch Stands, Including Connecting

Rods," adopted March, 1921, be revised to refer to this plan, to read:

"12. Lamp tips shall conform to plan No. 252."

In reference to article "Gage on Curves," adopted, Vol. 11, Part 2, 1910, pp. 942, 954, 955; Vol. 16, 1915, pp. 733, 1145, reading:

"GAGE ON CURVES"

Present	*Proposed*
"Curves 8 deg. and under should be standard gage. Gage should be widened ⅛ in. for each 2 deg or fraction thereof over 8 deg., to a maximum of 4 ft. 9¼ in. for tracks of standard gage. Gage, including widening due to wear, should never exceed 4 ft. 9½ in. "Where frogs occur on *the inside of* curves, the gage at the frog should be standard or the flangeway of the frog should be widened to compensate for the increased gage."	*For general conditions in main line tracks,* curves 8 deg. and under should be standard gage. Gage should be widened ⅛ in. for each 2 deg. or fraction thereof over 8 deg., to a maximum of 4 ft. 9¼ in. for tracks of standard gage. Gage, including widening due to wear, should never exceed 4 ft. 9½ in. Where frogs occur on curves, the gage at the frog should be standard or the flangeway of the frog should be widened to compensate for the increased gage. *For the widening of gage and flangeways on curves for the operation of specific locomotives or for special conditions and for curved crossings, refer to Tables No. 1 and No. 2 for "Gages and Flangeways in Curved Track."*

The committee recommended that the following supplementary tables be adopted and published in the Manual:

Table No. 1, dated November, 1921, and entitled "GAGES AND FLANGEWAYS IN CURVED TRACK"

Table No. 2, dated November, 1921, and entitled "GAGES AND FLANGEWAYS IN CURVED TRACK—GAGE DIAGRAMS FOR RIGID WHEEL BASE LOCOMOTIVES"

An explanation of these tables is given in Appendix F.

Appendix B—Typical Plans of Turnouts, Crossovers, Slip Switches, Double Crossovers and Railroad Crossings

The committee recommended the following plans for adoption:

Bolted Rail Crossings

Plan 701. Three rail design, angles 90 deg. to 50 deg. inclusive.
Plan 702. Two rail design, angles 90 deg. to 50 deg., inclusive
Plan 703. Three rail design, angles below 50 deg. to 35 deg., inclusive.
Plan 704. Two rail design, angles below 50 deg. to 35 deg., inclusive.
Plan 705. Three rail design, angles below 35 deg. to 25 deg., inclusive.
Plan 706. Two rail design, angles below 35 deg. to 25 deg., inclusive.
Plan 707. Single rail design and two rail design with short easer rails, angles below 25 deg. and above 14 deg. 15 min.
Plan 708. Single rail design and two rail design, angles below 25 deg. and above 14 deg. 15 min.
Plan 709. Single rail design and two rail design with short easer rails, angles 14 deg. 15 min. to 8 deg. 10 min., inclusive.
Plan 710. Single rail design and two rail design, angles 14 deg. 15 min. to 8 deg. 10 min., inclusive.

Manganese Steel Insert Crossings

Plan 751. Designs and dimensions of inserts, angles 45 deg. to above 14 deg. 15 min., Detail "A."
Plan 752. Designs and dimensions of inserts, angles 45 deg. to above 14 deg. 15 min., Detail "B."
Plan 753. Designs and dimensions of inserts, angles 14 deg. 15 min. to 8 deg. 10 min., inclusive.
Plan 754. Three rail design, angles below 45 deg. to 35 deg., inclusive, Detail "A."
Plan 755. Two rail design, angles below 45 deg. to 35 deg., inclusive, Detail "A."
Plan 756. Three rail design, angles below 35 deg. to 25 deg., inclusive, Detail "A."
Plan 757. Two rail design, angles below 35 deg. to 25 deg., inclusive, Detail "A."
Plan 758. Two rail design with short easer rails, angles below 25 deg. and above 14 deg. 15 min., Detail "A."
Plan 759. Two rail design, angles below 25 deg. and above 14 deg. 15 min., Detail "A."
Plan 760. Single rail design with short easer rails, angles below 25 deg. and above 14 deg. 15 min., Detail "A."
Plan 761. Single rail design, angles below 25 deg. and above 14 deg. 15 min., Detail "A."
Plan 762. Three rail design, angles below 45 deg. to 35 deg., inclusive, Detail "B."
Plan 763. Three rail design, angles below 35 deg. to 25 deg., inclusive, Detail "B."
Plan 764. Two rail design with short easer rails, angles below 35 deg. to 25 deg., inclusive, Detail "B."
Plan 765. Two rail design with short easer rails, angles below 25 deg. and above 14 deg. 15 min., Detail "B."
Plan 766. Single rail design with short easer rails, angles below 25 deg. and above 14 deg. 15 min., Detail "B."
Plan 767. Two rail design, angles 14 deg. 15 min. to 8 deg. 10 min., inclusive.
Plan 768. Single rail design, angles 14 deg. 15 min. to 8 deg. 10 min., inclusive.

Twelve of the above crossing plans were presented as information in report for annual meeting of March, 1921. These were resubmitted with such revisions as were found desirable, with additional plans to make the set complete.

The committee also recommended that the following plans be received as information only:

Plan 801. No. 8 double slip switch with movable center points with uniform risers.
Plan 802. No. 8 double slip switch with movable center points with graduated risers.
Plan 851. Details of No. 8 double slip switch with movable center points with uniform risers.
Plan 852. Details of No. 8 double slip switch with movable center points with graduated risers.

Appendix D—Specifications and Unit Track Work Schedules for Contracting Maintenance Work

The committee has confined its attention this year to the preparation of specifications and unit schedules for those classes of work which lend themselves most readily to unit measurements. Specifications and unit schedules are therefore presented for (1) the laying of rail, (2) the stripping of track, the removal of ties and the respacing of ties and (3) for ballasting.

SPECIFICATIONS FOR THE RELAYING OF RAIL

(1) The railway company's authorized representative shall arrive at a clear understanding with the contractor as to the force to be employed, the speed with which it is desired to have the work proceed, and the general traffic situation in the territory to be relaid, in order that proper plans may be made to proceed economically with the work specified. Prior to starting the work the contractor shall notify the railroad company's representative a sufficient time in advance so that speed and traffic restrictions in the territory in which the work is to be performed may be arranged with the operating department of the railway company.

(2) Rail must be closed for all scheduled passenger trains and as soon as possible after arrival, for all freight trains.

(3) Rail may be closed temporarily for the passage of trains during the hours while the work is in progress, inserted according to the standards of the railway company. All connections left in the track over night must be made with rails of full section and standard angle bars or joints. The railway company shall provide and the contractor shall pay for competent flagmen during the continuance of this work, to flag in accordance with the rules of the company for the protection of the work and traffic.

(4) The railway company will unload and distribute all rail, joints, bolts, spikes, tie plates, rail anchors and other materials to be inserted in the track.

(5) The contractor shall provide all tools needed in connection with this work.

(6) The railway company will provide the necessary inspector or inspectors and the instructions of such inspectors regarding the quality and type of work to be done shall be complied with at all times by the contractor.

(7) The contractor shall supply the necessary foremen and labor to prosecute the work properly and in such numbers as may be required by the chief engineer or his authorized representative, and at the request of the chief engineer or his representative will remove any foreman or man not satisfactory to the railway company.

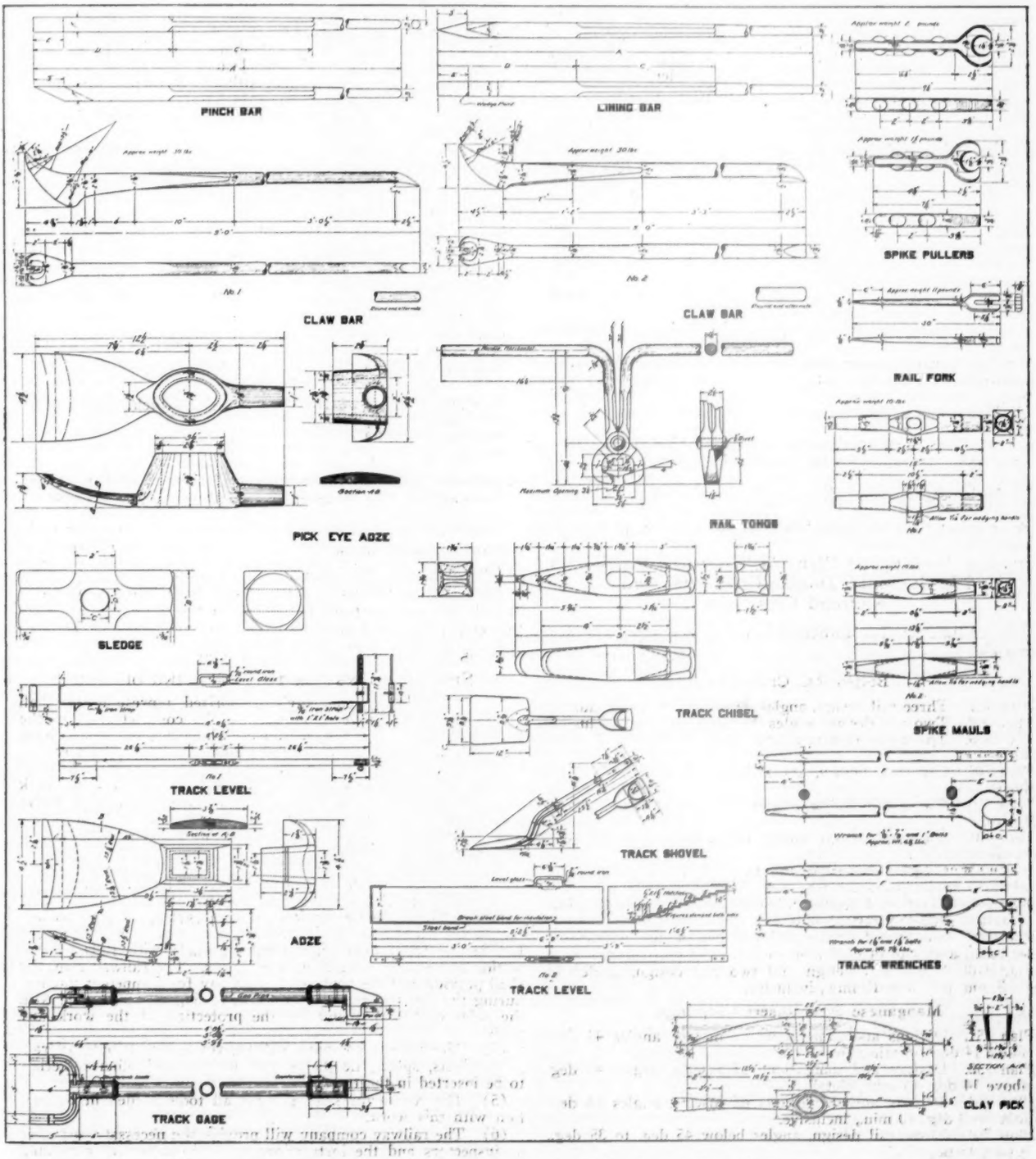
(8) Trains must not be permitted to use the track on tangents with spikes out of more than two consecutive ties and not more than six ties to any one rail, or on curves with the spikes removed from two consecutive ties. Proper gage must be maintained and all ties on which the rail does not have a full bearing must be tamped up and spikes driven down to avoid bending the rail.

(9) Track must not be allowed to go over night with spikes drawn in advance of the work.

(10) All spike holes must be plugged prior to adzing ties for rail or tie plate bearing.

(11) Ties must be adzed carefully, giving full bearing with the least possible cutting of ties. The bottom of the rail, the tie plate and the bearing surface of the tie shall be cleaned before the rail is laid. When replacing rail with rail of the same section, unless changing or adding tie plates, only two rows of spikes may be drawn, provided proper gage is maintained; in replacing rail with different section, three or four rows of spikes shall be drawn, as is necessary.

(12) Tie plates, when furnished, must be applied in a workmanlike manner at time rail is laid to avoid unnecessary spiking and must be so placed that the shoulder is in contact with the base of rail or the splice bar for the entire length of the shoulder.



Appendix C—Tools Recommended for Adoption as Standard

(13) Metal expansion shims must be used to provide for the proper openings between the rails and a thermometer shall be used to determine the thickness of the shims to be used, in accordance with the standards of the American Railway Engineering Association.

(14) At the close of each day's work all joints shall be full bolted, the bolts made tight and the rail full spiked.

(15) Necessary gaging must be done at the time rail is laid and should conform to the railway company's standard practice.

(16) Old rail must be left parallel with the track with joints uncoupled and all old bolts, nuts, spikes, tie plates, joints, etc., must be gathered up and left in neat piles on the ground, separated as between usable and scrap material in accordance with the railway standards, convenient for picking up by work trains.

(17) Excess material distributed for rail laying must be picked up by the contractor and taken ahead where it can be used.

(18) In laying rail on tangents the staggering of joints must be provided and in laying rail on curves care must be taken to put in short length rails at proper intervals in the low rail and to maintain the proper stagger throughout the curve.

(19) As far as possible all joints should be kept out of street and road crossings, using long or short rails for this purpose.

(20) Rails must be spiked in full to each tie. The inside and outside spikes shall be as far apart as the face and character of the tie will permit. The inside spikes shall be on the same side of the tie.

(21) All spikes shall be started vertically and square with the rail and so driven that the face of the spike shall have a full hold on the base of the rail. Spikes must not be straightened while being driven.

(22) Spikes must be drawn carefully with a view of using them again.

(23) All switches, frogs and guard rails must be placed in accordance with the railway company's standards.

(24) Switches must be left in proper adjustment, special care being given to bending of the stock rail.

(25) The contractor must restore and secure promptly all stock-guards, crossing plank, or other facilities displaced by reason of the rail laying, and must replace all safety and foot blocking removed in changing out switches, frogs and guard rails.

(26) The contractor is to understand that any work not specifically mentioned in the specifications, but which is necessary, either directly or indirectly, for the proper carrying out of the intent thereof, shall be required and applied, and he shall perform all such work just as if it were particularly delineated or described. Unless specifically mentioned above, all work shall conform to the standards of the railway company.

Specifications for the Ballasting of Track by Contract

(1) The railway company's authorized representative shall arrive at a clear understanding with the contractor as to the force to be employed, the speed with which it is desired to have the work proceed, the source of ballast supply and the general traffic situation in the territory to be ballasted, in order that proper plans may be made to proceed economically with the work specified. Prior to starting the work the contractor shall notify the railway company's representative a sufficient time in advance so that speed and traffic restrictions in the territory in which the work is to be performed may be arranged with the operating department of the railway company.

(2) The railway company will provide the necessary inspector or inspectors, and the instructions of such inspectors regarding the quality and type of work to be done shall be complied with at all times by the contractor.

(3) The contractor shall supply the necessary foremen and labor to prosecute the work properly and in such numbers as may be required by the chief engineer or his authorized representative, and at the request of the chief engineer or his representative will remove any foreman or man employed not satisfactory to the railway company.

(4) The railway company shall provide and the contractor shall pay for competent flagmen during the continuance of this work, to flag in accordance with the rules of the company for the protection of the work and traffic.

(5) Where required, banks shall be widened to the proper width prior to starting ballast work and a sufficient time in advance so that there will be no interference. Such widening of embankments and the proper grading of public or private crossings shall be done by the railway company unless specific instructions are given by the representatives of the railway company to the contractor to do such work.

(Note.—If contractor is to do bank widening work, specifications for such work must be provided.)

(6) Grade stakes will be set to the proper grade by the representative of the railway company before the ballast material has been dumped and spread.

(7) All tile, box or other drains required to take care of water between the tracks shall be placed before the ballast material is unloaded.

(8) The railway company will supply all equipment and train crews required for the loading, transporting, unloading and spreading of the ballast. The contractor shall supply all tools needed in connection with this work.

(9) The railway company shall furnish all ballast as required in its own cars and shall transport and switch such ballast free of cost to the contractor to the point where it is to be applied.

(10) Ballast shall be unloaded by the contractor by dumping or plowing as the means provided by the railway company permit. If the ballast is in center dump cars it shall be unloaded by having one or more cars opened at a time, allowing the required amount of ballast material to flow out as the train is moved along slowly. If the material is on flat or open cars, it shall be plowed off by means of an unloading machine while the train is moving at such a rate of speed as to provide the desired amount of material as uniformly distributed as possible. The unloaded material shall be leveled down by means of a ballast plow or spreader. Care shall be taken not to destroy or disturb the grade stakes.

(11) The preliminary surfacing gang shall follow the unloading as closely as the regularity of the ballast supply will permit. In using jacks, they must be placed close enough together to prevent undue bending of the rail or strain on the joints. Both rails must be raised at one time and as nearly uniformly as possible. The track shall be so lifted that after a period of not less than three days after the last lift it will be necessary to give it a final lift of not less than one inch nor more than two inches to bring it to the grade of the stakes. All ties that are pulled loose or renewed shall be replaced to proper position and must have a bearing against the rail and be fully spiked, with all spikes driven home before tamping. In driving spikes, all spikes shall be started vertically and square with the rail, and so driven that the base of the spikes shall have a full hold on the rail. Spikes must not be straightened while being driven. Ballast shall be well packed or tamped with pick, shovel, tamping bar or tamping machine, as directed, from a point eighteen inches inside of each rail on both sides of the ties to the end of the ties, tamping the outside of the tie first.

(12) When the track has been raised to within one or two inches of the final grade and properly compacted by traffic, a finishing lift shall be made by jacking up the track to the exact height provided for by the grade stakes. All allowance for settlement shall be taken care of in the setting of the stakes and the necessary ballast forked or shoveled in, and then driven to place by tamping machines, tamping picks, bars or shovels, as directed by the proper representative of the railway company. In making the finishing lift the spot board and level board must be used with care and the track brought to as true a surface as possible.

(13) The track shall be placed in good alinement before the finishing lift is made, but a lining gang shall follow one or two days behind the finishing lift and shall spot up all places found not to be holding up to proper surface, and shall line the track to as accurate an alinement as possible. Center stakes shall be set for the alinement before the finishing lift is made and the final alinement must conform to the center stakes.

(14) The contractor shall trim the ballast to conform to the standard roadbed section, and the railway company for this purpose shall supply its standard cross-section template. The portion of the sub-grade outside the ballast line shall be left with a full even surface and the shoulder of the embankment properly dressed to the standard roadbed section. The contractor shall dispose of any surplus ballast after trimming the ballast section as directed by the representative of the railway company.

(15) The contractor must restore and secure promptly all stock-guards, crossing plank, or other facilities displaced by reason of the ballasting.

(16) After ten days' use of the track by the railway company the contractor shall go over same and surface and line low joints and spots which may have developed without extra charge to the railway company.

(17) The contractor shall remove from the railway company's property all rubbish and waste from any ballast work, or dispose of it as directed by the representative of the railway company. After completing the work the contractor shall remove from the railway company's property, and from all public and privately-owned property, at his own expense all temporary structures and waste resulting from his camping operations.

(18) In measuring the work, lining, surfacing and trimming turnouts and crossovers shall be considered as main track.

(19) The contractor is to understand that any work not specifically mentioned in the specifications, but which is necessary, either directly or indirectly, for the proper carrying out of the

intent thereof, shall be required and applied, and he shall perform all such work just as if it were particularly delineated or described. Unless specifically mentioned above, all work shall conform to the standards of the railway company.

Specifications for the Stripping of Track, the Renewal of Ties and the Respacing of Ties

(1) The railway company's authorized representative shall arrive at a clear understanding with the contractor as to the force to be employed, the speed with which it is desired to have the work proceed, the source of ballast supply and the general traffic situation in the territory in question, in order that proper plans may be made to proceed economically with the work specified. Prior to starting the work the contractor shall notify the railway company's representative a sufficient time in advance so that speed and traffic restrictions in the territory in which the work is to be performed may be arranged with the operating department of the railway company.

(2) The railway company shall furnish the ties required for renewal purposes at convenient points along the right-of-way.

GAGES AND FLANGE-WAYS IN CURVED TRACK. TABLE No. 1.

RIGID WHEEL-BASE OF LOCOMOTIVE AND NUMBER OF FLANGED DRIVERS.							GAGE.												
5 PAIRS ALL FLANGED DRIVERS SEE NOTE 2	5 PAIRS OF DRIVERS CENTER DRIVER BLIND	4 PAIRS ALL FLANGED DRIVERS	3 PAIRS ALL FLANGED DRIVERS		2 PAIRS ALL WHEEL-BASES, SEE NOTE 1.		DEGREE OF CURVATURE.												
			"G"	"P"			33°	30°	28°	26°	24°	22°	20°	18°	16°	14°	12°	10°	8°	6°
					11-0	WHEEL BASE	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•	•	•	•	•
			11-0	11-6	•		4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•	•	•	•	•
			11-6	12-0	•		4'-9⅜"	4'-9"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•	•	•	•	•
		"G"	"P"	12-6	15-0	•		4'-9⅜"	4'-9⅜"	4'-9⅜"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•	•	•	•
			15-0	13-6	14-0	•		4'-9⅝"	4'-9⅜"	4'-9⅜"	4'-9⅜"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•	•	•
		15-0	16-0	14-0	15-0	• B			4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•	•
	"G"	"P"	16-0	17-0	15-0	15-6	•			4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅜"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	•
		19-0	17-0	17-6	15-6	16-0	• A				4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"
	19-0	20-0	17-6	18-0	16-0	•					4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅜"	4'-9"	4'-8½"	4'-8½"	4'-8½"	4'-8½"	4'-8½"
"G"	"P"	20-0	21-6	18-0	19-0	•							4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-8½"	4'-8½"	4'-8½"	4'-8½"
	19-0	21-0	22-6	19-0		•								4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9"	4'-8½"	4'-8½"	4'-8½"
19-0		22-6				•									4'-9⅝"	4'-9⅝"	4'-9⅝"	4'-9"	4'-8½"	4'-8½"

COLUMNS "P" GIVE MAXIMUM WHEEL BASES FOR PLAIN UNGUARDED CURVES, AND COLUMNS "G" GIVE MAXIMUM WHEEL-BASES FOR GUARDED PORTIONS OF CURVES TO BE OPERATED ON GAGES AND DEGREES OF CURVATURE, AS PER TABLE.
WIDTHS OF FLANGE-WAYS FOR GUARDED CURVES AND CURVED CROSSINGS = GAGE MINUS 4'-6⅝".

NOTES:
1. APPLICABLE TO LOCOMOTIVES WITH ONE OR MORE PAIRS OF BLIND CENTER DRIVERS. - "ALL WHEEL BASES" REFERS TO PRACTICAL LIMIT OF APPROXIMATELY 22'-6" MEASURED FROM CENTER TO CENTER OF OUTSIDE FLANGED DRIVERS.
2. DRIVERS ON FLOATING AXLES ARE NOT COUNTED AS FLANGED DRIVERS NOR IN THE RIGID WHEEL-BASE.
3. FRONT AND REAR TRUCKS MUST HAVE SUFFICIENT SWING FOR DEGREE OF CURVE, TO OPERATE ON GAGE AND WIDTHS OF FLANGE-WAYS GIVEN.
4. GAGES GIVEN ARE TO THE NEAREST ONE EIGHTH INCH WITH AN ALLOWANCE OF APPROXIMATELY 3/8" FOR 3 PAIRS OF DRIVERS AND 1/2" TO 5/8" FOR 4 PAIRS, AND 5/8" TO 3/4" FOR 5 PAIRS, AS TOTAL GAIN IN LATERAL PLAY AT JOURNAL-BOXES AND TIGHT SETTING OF OUTSIDE DRIVERS.
5. GAGES AS PER SERIES "A" MAY BE USED FOR GENERAL CONDITIONS IN MAIN LINE TRACKS UNLESS IT IS KNOWN THAT EXTRA LARGE LOCOMOTIVES OPERATE OVER IT. - GAGES AS PER SERIES "B" MAY BE USED IN YARDS AND SIDINGS WHERE MAIN LINE LOCOMOTIVES DO NOT OPERATE, UNLESS OTHERWISE SPECIFIED.
6. FOR GENERAL NEW WORK 4'-8½" GAGE SHOULD NOT BE EXCEEDED. FOR ECONOMY IN MAINTENANCE IN CURVED CROSSINGS 4'-9" GAGE WITH 2¾" FLANGEWAY AND CORRESPONDING CURVATURE SHOULD NOT BE EXCEEDED.

Table 1—Gages and Flangeways in Curved Track

(3) The contractor shall supply all tools needed in connection with this work.

(4) The railway company shall provide the necessary inspector or inspectors and the instructions of such inspectors regarding the quality and type of work to be done shall be complied with at all times by the contractor.

(5) The contractor shall supply the necessary foremen and labor to prosecute the work properly and in such numbers as may be required by the chief engineer or his authorized representative, and at the request of the chief engineer or his representative will remove any foreman or man employed not satisfactory to the railway company.

(6) The track shall be skeletonized not to exceed two days in advance of the unloading of the ballast. Where the old material is suitable for sub-ballast and conditions permit the raising of the track, it will be raised and the old material spread under and between the ties to the proper width as uniformly as practicable. When conditions do not permit the raising of the track, the old material shall be removed to the required depth and disposed of as directed, or where the material is not suitable for sub-ballast, it shall be removed to the plane of the bottom of the ties, or deeper if necessary to preserve the grade line, and shall be placed on the outer shoulder of the road bed, preferably at such points as will tend to even up the line of the shoulder. Upon the completion of this work the surface of the sub-grade shall be sloped with reasonable uniformity so as to provide proper drainage to the shoulder of the embankment.

(7) Following the skeletonizing of the track, all old ties which are not fit for more than one year in track where gravel or cinder ballast is to be used, or for more than two years in track where stone or hard slag is to be used, shall be removed and new ties inserted in their places. The largest and best ties shall be used at the joints. The heart side of ties should generally be turned down, but they should be laid so as to obtain the best bearing. The adzing shall be done carefully and so as to provide full bearing for the tie plate or rail, with the least cutting possible to obtain bearing on solid wood.

(8) On single track ties shall be lined with the line rail on tangents, and with the inside rail on curves. On double track ties shall be lined to the outside of both tracks. Where there are sidetracks on each side of the main track, the side track ties must be lined to the outside of such tracks.

(9) Picks should not be stuck into a tie to drag it into place, nor should ties be struck on the end with a tamping pick or spike maul. Tie tongs should be used to handle all ties.

(10) When old ties are taken from track, all tie plates and spikes must be carefully removed and preserved. The old ties shall be neatly piled for such inspection and disposition as the railway company's rules require.

(11) Ties should not be stood on end in close cuts.

(12) All treated ties shall be dated and where standard galvanized dating nails are used they shall be applied the day the ties are placed in the track. The position of the nail should be in accordance with standard instructions for that year.

(13) The spiking of the rails shall be done as directed by the railway company's representative. Where splices are slotted, spikes must be driven in the slots, except on bridges and open deck trestles, where spikes must not be driven either in the slots or against the ends of the splices. Two spikes shall be used with tie plates except when otherwise directed by the railway company's representative, only good or new spikes to be used. Spikes must be driven plumb and touching the base of the rail, so that when driven they will hold the rail to gage, and the under side of the head will have full bearing on the base of rail. They must be driven down until the head is tight against the rail, but no further blows should be struck after the spike has been driven home. Every hole from which a spike is drawn must be plugged in advance of the adzing. Spikes much be drawn carefully with a view of using them again.

(14) Joint ties shall be spaced in accordance with the railway company's standard plans, intermediate ties shall be spaced uniformly and all ties shall be laid square with the rail. The number of ties per rail shall be as required by the railway company's standard plans.

(15) The contractor is to understand that any work not specifically mentioned in the specifications, but which is necessary, either directly or indirectly, for the proper carrying out of the intent thereof, shall be required and applied, and he shall perform all such work just as if it were particularly delineated or described. Unless specifically mentioned above, all work shall conform to the standards of the railway company.

Appendix E—Plans and Specifications for Switch Stands, Switch Lamps and Switch Locks

In Appendix A, Item II, plan 252, covering details of lamp tips for switch stands, was submitted for adoption as a supplement to the Manual, completing Section 12

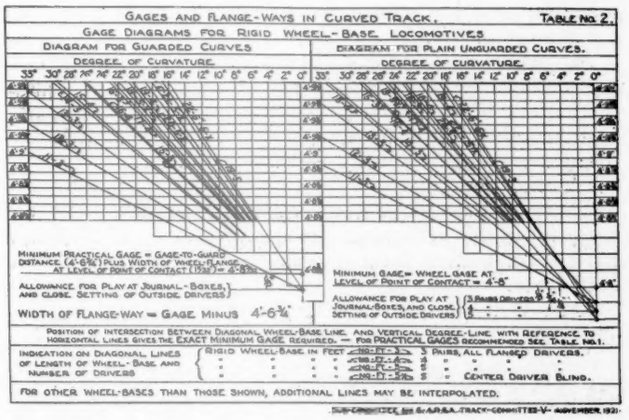


Table 2—Gages and Flangeways in Curved Track

of Requisites for Switch Stands, including Connecting Rods, adopted March, 1921.

The committee submitted plan No. 254 of 10-inch and 9-inch day target discs for attachment direct to switch lamps for low and extra low switch stands, and recommended that it be adopted as standard. This is an outline plan only and conforms to dimensions on A. R. A. Signal Section plan No. 1445 for the 10-inch day disc, to which reference is made for further details.

The committee also recommended that the following A. R. A. Signal Section plans of switch lamps be ap-

proved and endorsed without publication in the A. R. E. A. records:

Plan 1440. Switch lamp (spherical type), approved March, 1921.

Plan 1441. Switch lamp base-socket for spherical type switch lamp (Plan 1440), approved March, 1921.

Plan 1442. Lens, hoods and couplings for switch and semaphore lamps (see plans 1440 and 1460), approved March, 1921.

Plan 1443. Oil fount for spherical type lamp (Plan 1440), approved March, 1921.

Plan 1460. Switch lamp (cylindrical type).

Plan 1461. Switch lamp base-socket for cylindrical type switch lamp (Plan 1460).

Appendix F—Gages and Flangeways for Curved Crossings

Tables 1 and 2 are submitted in Appendix A, Item III, for adoption and publication in the Manual. Table 1 is based on the theoretical study submitted in last year's report. The columns on the left give the approximate rigid wheel base of locomotives in combination with the number of pairs of flanged drivers stated that will operate on the gage of the track shown on the right under "Degrees of Curvature." Two columns are given for the wheel bases; one for plain, unguarded curves, and the other for guarded curves and curved crossings.

Table 1 is sufficiently correct for general practical purposes. The figures for the gage are within ⅛ in. and the figures for the wheel base within 6 in. in order to avoid the use of smaller fractions.

For finding the more nearly exact gage necessary for a given locomotive on a given curve in cases where it may be desirable, the graphic Table 2 is also submitted.

Discussion

(Chairman Wiltsee presented the report and *moved the adoption of plans 701 to 710, bolted rail crossings.*)

C. W. Baldridge (A. T. & S. F.): I do not find any built-up crossing showing an easer rail extending beyond the joint of the rail. I have had occasion to follow up some crossings with long easer rails, as compared with short easer rails, and an easer rail extending the matter of 14 or 18 in. beyond the joint will last longer than a similar crossing with a short easer rail.

(*Motion carried.*)

Mr. Wiltsee: *I move the adoption of Plans 751 to 768 inclusive—Manganese Steel Insert crossings.* These plans have been before the committee for several years, and are the result of the work of the Committee of Manganese Track Society in this committee.

(*Motion carried.*)

There seemed to be some misunderstanding. We did not print in this addendum the specifications which should have accompanied these crossing frog plans, and I will read them.

(Mr. Wiltsee then read the following):

APPLICATION OF CROSSING DESIGNS AND RECOMMENDED PRACTICES

1. Plans Nos. 701 to 710, inclusive, for bolted rail crossings, and plans Nos. 751 to 768, inclusive, for manganese steel insert crossings, are applicable for all rail sections from 80 pounds per yard up, and from 2⅜ to 3 in., inclusive, width of head.

2. The plans represent recommended practice for general conditions and are subject to modifications under special conditions. Added features such as guard rails or easer rails extended beyond the end joints may be specified without departing from the general design.

3. The single rail designs for crossings below 25 deg. angles are recommended only for tangent track or for curved track not exceeding 6 deg.

4. Rigid center frogs are not recommended below 8 deg. 10 min. on tangent track. For curved track the recommended limiting angle for rigid center frogs is 9 deg. 30 min., for curves 6 deg. and under, increasing one degree for each 2 degrees of greater curvature up to a maximum angle of 15 deg. 30 min. for 18 deg. curves and over. Movable point crossings are recommended below these limits.

5. The gage of crossings in tangent track and curves up to 6 deg. shall be standard of 4 ft. 8½ in., and flangeway standard of 1¾ in. wide. In crossings on sharper curves the gage and width of flangeway shall be widened, if required, to suit the equipment operating through them. For economy in maintenance, curved crossings requiring wider than 4 ft. 9 in. gage, and 2¼ in. flangeway are not recommended.

6. In laying out bolted rail crossings to a given angle falling within the limits given on typical plans, follow general design, adjusting bolt spacing to suit angle, using number of bolts shown on plan.

7. Designs with easer rails are recommended for all but light traffic.

8. The use of base plates (either corner plates or continuous plates) is recommended for all bolted rail crossings from 35 deg. up and for designs with easer rails below 35 deg. For crossings of frog construction, 14 deg. 15 min. and under, special tie plates may be used in place of base plates.

9. For manganese steel insert crossings the size of the insert is determined by the formulae on plans Nos. 751, 752 and 753, for angle "A" of crossing expressed in degrees and decimals of a degree, and typical design followed in all other respects. For angles from 45 deg. to above 14 deg. 15 min. the plans cover two general types marked Detail "A" and Detail "B," respectively, to be selected as may be preferred.

10. Base plates on manganese steel insert crossings are recommended for all angles above 14 deg. 15 min. For crossings of frog construction, 14 deg. 15 min. and under, special tie plates may be used when so specified.

The President: Is there any discussion of these specifications?

J. V. Neubert (N. Y. C.): As I understand it, these are not specifications, but merely explanations of these plans.

Chairman Wiltsee: If it is in order, *I will move the adoption of these explanations to be printed with the plan in the Manual.*

Earl Stimson (B. & O.): In seconding the motion I would like to express confidence in the committee, that what they have to offer is not a specification, but merely an explanation, and that the plan would be rather incomplete unless that was included.

Mr. Neubert: I feel it is very improper to print something as recommended practice that has not been considered by the association.

E. A. Frink (S. A. L.): It will be unfortunate if this committee has to see the results of its work carried over for another year. A large part of it is explanatory, which we can adopt without question.

(*A motion was then made to read the section by paragraphs, after which the entire section was adopted.*)

(*The motion to include the matter under consideration in the Manual was put and carried.* Chairman Wiltsee then presented revisions of the Manual (Appendix A) *which was adopted.* T. T. Irving (Grand Trunk) then presented Appendix C on track tools and said):

"There is one dimension missing in the pick eye adze. In the elevation drawing the bottom dimension should be marked 3 in."

Chairman Wiltsee: *I move the adoption for printing in the Manual of the following plans:* Pinch bar, lining bar, claw bar, track wrenches, adze, pick eye adze, spike pullers, rail fork, track gage, rail tongs, track chisel, clay pick, spike mauls, sledge, track level, track shovel.

C. E. Lindsay (N. Y. C.): The limit of wear on lining bars and switch bars is indicated in outline in the drawings by a measurement from the initial point of the bar. If the point is worn off there is no place to measure from. Also, I think it necessary to show the owner's name on the bar as the manufacturer's name. Why is it necessary to have bars of 18 lb. weight and bars of 20 lb. weight? Why not have two classes—18 lb. and 26 lb?

Mr. Baldridge: The size of the jaws of the rail tongs appear unnecessarily close to the size of the present rail head. Rail tongs ordinarily last a good while and it would be better to allow a little larger spread and depth

to take care of a variation greater than is shown. I believe that 2¼ in. depth, which is the amount allowed here, is hardly enough clearance to protect against what may occur in the design of rail heads in the future, and there is no reason for holding to a close fit between the depth of the grip of the tongs and the rail head.

L. J. F. Hughes (C. R. I. & P.): In determining upon a design of track gage was the type of gage considered in which there is a curved fillet on the face that bears against the rail to allow for a possible bead on the rail? If this has been considered what are the reasons for not embodying this feature in the one set forth as standard?

Earl Stimson (B. & O.): The double-ended track wrench is in quite general use and I would like to have some expression from the committee as to why they limit the design to the single-ended wrench.

Chairman Wiltsee: The question of the track gage with a beaded edge to take care of the lip on the rail was before the committee and discussed considerably. On account of the wear, and not being able to get a very strong gage, especially at that point, the committee thought that this type of gage, which provides for gaging the track at a gage point ⅝ in. below the top, was a strong gage and better in all respects. In regard to the double-ended track wrench, the committee did consider that question, but decided that the single end wrench was preferable, although there is no objection to using a double-ended wrench if anyone desired. I think that ordinarily for rail-laying gangs the single-ended wrench is preferable, particularly with the drift end, but possibly on a section the double-ended wrench may be preferable. I did not include the track shovel in my motion to adopt this plan.

Mr. Baldridge: I am inclined to agree with the gentleman that spoke in regard to the track gage. This form of track gage as shown is all right to put on new rail, but practically all rail of the present day acquires a V, or an overhang projection on the gage side of the rail after comparatively short service. On the Santa Fe we use a gage which provides a recess at the upper corner under the gage at the gage point to take care of that irregularity in the head of the rail, and I think that such a gage is preferable to the one shown.

(The portion of the report in Appendix D was presented by E. T. Howson *(Railway Age)*, chairman sub-committee.)

Chairman Wiltsee: *I move the adoption of the specifications in Appendix D be adopted and printed in the Manual.*

Mr. Stimson: Will the committee please state whether the unit track work schedules are to be made part of the specifications, and if not, just what they are supposed to be

Mr. Howson: The unit track work schedules were submitted in accordance with our instructions and also as an example of the operations included within this specification.

Mr. Baldridge: I suggest, that a clause be inserted between articles 19 and 20, in the specifications for relaying rail, reading:

"New rail shall be so laid that insulated joints will be brought near enough to the old location of the insulated joints so that it will not be necessary to move trunking, wiring, etc."

Chairman Wiltsee: The committee will accept that amendment.

W. C. Barrett (L. V.): Has the committee considered in this specification for laying rail, the use of machines by contractors? Apparently the specification calls only for the laying of rail by hand.

Mr. Howson: The committee soon realized that it must confine its specifications to those details of work which were of fairly common application and endeavored to provide a skeleton and the basic principles which would serve any individual road, so reference to the use of mechanical equipment, which varies in detail, was left out.

Chairman Wiltsee: If the members will apply these specifications to their own conditions, they will find some few changes or revisions, which are naturally to be expected. I just had occasion to do this on our own road, and found that I had only a few changes to make to suit our conditions.

Mr. Lindsay: I would dislike very much to see this convention degenerate into a rubber-stamp. The committee gave no indication that this subject was to be included in the Manual. I think we should jealously safeguard the Manual. The whole subject of contract work is boiling. Nobody knows where we are. These specifications will be of value in guiding those who are undertaking other processes, but I submit that there has not been sufficient time to study this subject in its entirety and to go into it as it should be done before it is inserted in the Manual. *I therefore move to amend the motion to the effect that this subject be accepted as information and placed in the Proceedings.*

Mr. Stimson: I must say I concur fully in Mr. Lindsay's amendment. The question asked the committee was not answered with sufficient clearness as to just what use or what purpose unit track work schedules serve in the specification.

(*Mr. Lindsay's motion was adopted; also the original motion as amended.*)

(That portion of the report on plans and specifications for switch stands, switch lamps and switch locks was presented by J. deN. Macomb, A. T. & S. F., chairman of the sub-committee. Appendix E was then discussed and this was followed by a reference to six Signal section plans, the intention being to read them into the Manual, but not to republish the drawings or material as it is a duplication of Signal section material. In that connection the committee felt that this is the border line between the Signal section's jurisdiction and A. R. E. A. jurisdiction, and that recognizing the Signal section's standard is as far as it could go.)

Chairman Wiltsee: *I move the adoption and printing in the Manual of Plan No. 254 of 10 and 9 in. targets.*

(*Motion carried.*)

Chairman Wiltsee: *I move the adoption for printing in the Manual of our approval of the Signal section plans Nos. 1440-41-42-43-1460-61, these to be approved and endorsed without publication of the plans.*

(*Motion carried.*)

Chairman Wiltsee: (Reading on pp. 671 and 672.) *I move the adoption for printing in the Manual of Plan No. 252, and also the revision of Sec. 12 as proposed.*

(*Motion carried.*)

(Appendix F was presented by V. Angerer, chairman of sub-committee on Gages and Flangeways for Curved Crossings.)

Chairman Wiltsee: *I move that Tables Nos. 1 and 2 be adopted and printed in the Manual.*

(*Motion carried.*)

Chairman Wiltsee: There is revision of the Manual necessary in connection with Gage on Curves in Appendix A.

I move that these be adopted and printed in the Manual.

(*Motion carried.*)

On the subject, "(a) Tests of tie plates subject to

brine drippings; (b) effect of brine drippings on track appliances," we expect to conduct further inquiries and the committee will report at a later time.

The next subject is: "Investigation on reduction of taper of tread to 1 in 38 and on canting the rail in track inward." The sub-committee has not been able to get much of value, and the report is submitted as information.

Report on Shops and Locomotive Terminals

The dependable operation of ash pits hinges on such factors as the use of mechanical equipment to make work more attractive to labor, the availability of spare parts to insure uninterrupted service, the provision for liberal storage space for ashes and their actual disposal. The recommendations of the committee outline how dependability may be obtained under different circumstances and with different classes of equipment. The committee presents a plan of a typical engine terminal for a 30-stall house and shop facilities with suggestions for adapting the plan to lesser needs. The design provides also for a future expansion of 100 per cent.

F. E. Morrow
Chairman

F. E. Morrow is finishing his second year as chairman of this, the newest of the association's standing committees, its appointment having been authorized only two years ago. In his capacity as assistant chief engineer of the Chicago & Western Indiana, the largest terminal railway in the Chicago district, Mr. Morrow is brought into daily contact with the problems of the committee. Because of this concentration upon terminal matters he is particularly well fitted to direct the committee in the development of its plans for the preparation of standard designs of the various types of terminal buildings and allied facilities for a period of over ten years.

THE COMMITTEE recommended that the findings and conclusions on Ash Pits, as embraced in the summary of Appendix A, be adopted and placed in the Manual in lieu of the material now appearing in the Manual under this subject.

The committee recommended that the findings and conclusions on Ash Pits, as embraced in the summary of Appendix A, be adopted and placed in the Manual in lieu of the material now appearing in the Manual under this subject.

The committee recommended that the findings and conclusions on Engine Houses, as shown in Appendix B under recommended changes in Manual, be adopted and placed in the Manual.

The committee recommended that the reports on Engine House Layouts and Car Shops, as shown in Appendices C and D, be accepted as information only and incorporated in the Proceedings.

Committee: F. E. Morrow (C. & W. I.), chairman; A. T. Hawk (C. R. I. & P.), vice-chairman; C. N. Bainbridge (C. M. & St. P.), Leland Clapper (D. & I. R.), George H. Gilbert (Sou.), E. M. Haas, G. W. Harris (A. T. & S. F.), L. P. Kimball (B. & O.), M. A. Long, J. W. Pfau (N. Y. C.), John Schofield (C. N. R.), A. M. Zabriskie (C. of N. J.), G. W. Burpee, W. H. Cookman (Penna.), Walter Goldstraw (G. T.), R. J. Hammond (B. & M.), E. A. Harrison (A. T. & S. F.), W. T. Krausch (C. B. & Q.), J. B. Maddock (C. of Ga.), L. K. Sillcox (C. M. & St. P.), L. L. Tallyn (D. L. & W.).

Appendix A—Ash Pits

(The following is an abstract of the summary of the report on this subject.)

RECOMMENDATIONS REGARDING COMMON TYPES OF ASH PITS AND METHODS OF ASH DISPOSAL

(1) All ash pits should have water pipes conveniently arranged for quenching fire and for attachments of hand hose for use of fire cleaners on each side of each engine.

(2) In estimating ash storage, and deciding the required size of skips, hoppers, etc., the average amount of ashes per engine and the maximum amount for any one engine should be determined from a knowledge of local conditions. With such information lacking, the average amount of ashes per engine should be assumed as not less than two yards and preferably two and one-half yards; and in the design of skips and hoppers the maximum amount of ashes from any one engine should be assumed as not less than two and one-half yards and preferably three yards.

(3) Length of pits handling two engines per track should be from 1½ to 1¾ times the length of a single engine, and length of pits handling three engines per track should be between 2½ and 2¾ times the length of a single engine. The length of engine selected should suitably reflect existing and probable future operating needs.

(4) The cleaning of locomotive fires on the line is often an operating necessity, though it involves some risk to traffic unless ashes receive proper attention. Such fire cleaning should be prohibited, except at designated locations between fixed limits where proper attention can be given to the removal of the ashes.

(5) Where only a few engines are handled daily, many small ash pit arrangements may be suitable, but consideration should be given to the use of a shallow pit constructed of non-combustible material and located between the rails.

(6) The depressed track pit, with ashes removed to cars by hand, has given fairly satisfactory service throughout the country for many years at terminals handling from a few up to a hundred or more engines per day. With modern labor conditions and operating requirements, the general use of this type of pit is not recommended, though under favorable labor conditions, and under conditions not favorable to the use of machinery, such pits will probably continue in satisfactory service at some terminals. Where such pits are to be used, it is recommended that they generally embody the following features:

(a) The concrete should be of a dense and rich mixture, with preferably slag or trap rock used for the aggregate.

(b) For safety and economical maintenance, both rails should be supported on cast iron or cast steel pedestals, even though a continuous curtain wall be used under one rail.

(c) The pavement should be of vitrified or fire brick on a concrete base.

(d) The distance from base of rail to pavement should be not less than three, nor over four feet.

(e) To prevent the washing of ashes down onto the depressed track, the retaining wall should project slightly above the paving, with drain holes through it.

(f) The vertical distance from top of rail of the depressed track to the edge of the shoveling platform should be not less than 4 ft. 6 in. and usually not over 5 ft. 6 in., based upon easy shoveling into cars of ordinary height and possible shoveling into cars nearly 11 ft. high.

Deep water pits are recommended for use where 60 or more engines are handled daily, provided the engine terminal layout is so fixed that the ash pit investment may be considered reasonably permanent, and provided that the climate is not so cold that great trouble is apt to be experienced with frozen ash cars. It is recommended that such pits embody the following features or ideas:

(a) Ashes should be removed to cars with clam shell buckets operated by locomotive, gantry or overhead cranes. At double pits, if the use of a locomotive crane is required for more than two or three hours per day, then dependability of operation will begin to be affected and an overhead crane should be installed.

(b) Engine and ash car tracks should be spaced far enough from adjacent tracks to afford suitable clearances for the future construction of an overhead crane runway.

(c) The smaller layouts should provide at least two engine tracks, or consist of two separate, single engine pits in the same track, with suitable crossovers to a running track and with an independent ash car track, this latter arrangement being recommended only where local conditions make the usual two-engine pit undesirable.

(d) The larger layouts should provide at least two engine tracks and one or more independent ash car track, all spanned or served by a crane. Where the extra cost involved can be justified, complete non-interference between the work of loading ashes and the cleaning and handling of engines can be obtained by locating the ash track between the engine tracks.

(e) The distance center to center of engine tracks over pits should be not less than 18 ft., and correspondingly increased if sidewalks are provided. The depth of pit and the slope of the side walls should be such that ashes will slide freely to the middle, where they can readily be reached by the bucket. Ashes will not flow freely on a slope less than one to one.

(f) Such rails as do not bear on side walls should be supported on pedestals spaced relatively close together in order to permit the use of shallow beams and reduce maintenance cost in the replacement of these beams. Spare bearing beams should be kept in stock at all times so that prompt replacement of defective beams can be made. The use of bare beams probably will be safer and cheaper than to attempt to protect such beams from rust and warping from the heat.

(g) The bottom of the pit should be protected with old rails or otherwise to guard against blows and scraping action of the clam shell bucket.

(h) Special attention should be given to the use of catch basins and other arrangements to keep the cinders from filling up drain pipes.

(i) Consideration should be given to safeguards against accidents resulting from men falling into the pit. Good protection is afforded by inner sidewalks with railings. These can be installed only when so provided in the original design, and even then at a decided increase in cost on account of increased track centers and depth of pit for equal ash storage.

Shallow water pits are recommended for use under under about the same conditions as are deep water pits. In all cases, the ashes should be handled by overhead crane. Comparing these two types, it may be said for equal lengths, the shallow water pit will be cheaper construction, and therefore more economical in fixed charges. If, however, on account of the reduced ash storage the length of the pits be increased, then the advantage of economy may be partly or wholly lost. Such pits should embody the following features:

(a) Engine tracks and ash car tracks should alternate in either a three or five track unit under one crane.

(b) The pits should be as wide between the rails as they can be constructed. The side walls and bottom of the pit should be protected against rubbing by clam shell bucket, which should be extra long to obtain good capacity. Height of pit walls should not be less than four feet or more than four feet six inches.

(c) Between tracks a water shedding pavement should be provided so sloped as to drain to the pits.

Appendix B—Engine Houses

The committee recommended that the text now appearing in the Manual, 1915 Edition, under the title "Engine House Design" be changed to read as follows. Sections changed are indicated by an asterisk:

Form.—*(a) The circular form under ordinary conditions is preferable.

*(b) Special conditions may render a rectangular house desirable, such as restricted location, small number of engines handled, greater ease of providing "Y" than turntable, etc.

(c) At shops where a transfer table is used, a rectangular engine house served by the transfer table may be desirable.

Turntable.—(a) The turntables should be long enough to balance the engine when the tender is empty.

*(b) A deck turntable is preferable to a through table when the cost of construction is no greater.

*(c) At important terminals, turntables are most economically operated by mechanical means.

*Where electric power is available, an electric tractor is the most efficient means of operating a turntable. The power wires may be led to the table either underground or overhead.

*Where electric power is not available, a compressed air motor may be used to propel the table. In this case, the locomotive itself usually furnishes the compressed air.

(d) The deck on the turntable should be wide enough to provide a walk on each side and be protected with hand rails.

Turntable Pit.—*(a) The turntable pit should be drained and paved.

*(b) The circle wall should be of masonry, with proper supports and fastenings for rails on the coping. A timber coping is considered a proper support and preferable to a rigid masonry coping.

*(c) The circle rail should preferably bear directly on masonry base.

(d) Easy access to the parts of a turntable for the oiling of bearings, painting and inspection should be provided in the design of the turntable pit, unless ample provision is made in the turntable itself.

Door Openings.—*The clear opening of entrance doors should not be less than 13 ft. in width and 17 ft. in height.

Doors.—Doors should be easily operated, fit snugly, be easily repaired and maintained, and should admit of the use of small doors.

Tracks.—(a) Lead tracks to the turntable should line up with tracks of the engine house where possible.

(b) Tracks should be on a level grade and should be provided with stop blocks.

(c) Special fastenings of the track rails at the circle wall and on the turntable are desirable to prevent movement of the rails, to give good bearing and to lessen the damage from derailed wheels.

Position of Locomotive.—In a circular house the locomotive should stand normally with the tender toward the turntable.

***Length of House.**—The length of stall along center line of track should be at least 20 ft. greater than the overall length of the locomotive to provide trucking space of 10 ft. in width in front of the pilot and space in which to detach the tender and provide a walkway between it and the engine without opening the door.

Materials.—(a) The materials used in construction of the house should be non-corrosive, unless proper care be taken to prevent corrosion.

*(b) The additional security against interruption to traffic from fire warrants serious consideration of the use of a fireproof roof or dividing the engine house into units of approximately 10 stalls by the use of division walls of fireproof material.

*(c) Omit.

*(c) The portion of the wall directly in line of the track where the engine is liable to run into it, should be so constructed as to be easily replaced or repaired when damaged.

***Engine Pits.**—Engine pits should extend from a point 10 ft. from the inner circle columns to a point 13 ft. from the inner face of the outer circle wall. The clear width should be 4 ft.: depth below base of rail, minimum 2 ft. 6 in., increasing with the slope of the floor of the pit to at least 3 ft. 0 in. The walls should be about 2 ft. 7 in. thick to provide proper support for jacking timbers. The clear width may be reduced a few inches when direct heating is used to permit the provision of recesses in the side walls for radiators and still allow ample support for the rails.

The floor should be convex and the drainage toward the turntable unless topographical conditions dictate otherwise.

***Smoke Jacks.**—The smoke jacks should be fixed. The bottom opening should be not less than 42 in. wide, and long enough to receive the smoke from the stack at its limiting positions, due to the adjustment of the driving wheels to bring the side rods in proper position for repairs. The bottom of the jack should be as low as the engine will allow, and it should be furnished with a drip trough. The slope upward should be uniform to the

flue. The area of the cross-section of the flue should be not less than 7 sq. ft. The jack should be preferably non-combustible. Wooden jacks properly built are considered reasonably non-combustible.

(This type of jack applies to all houses where regulations will permit. In some cities, where smoke abatement laws are in force, special types of jacks are necessary.)

When the engine house is without a turntable, smoke jacks should be located at each end of each engine space.

***Floors.**—The floors should be of permanent construction sloped so as to drain properly. The floor around the outer circle and for the outer bay or outer two bays where trucking is carried on and most of the work is done, may advantageously be constructed of wood block, or vitrified brick on a concrete base, while the remainder of the floor between pits may for the sake of economy be of concrete.

***Drop Pits.**—The number and type of drop pits depends on the purpose for which the particular house is used and the class of power handled.

Ordinarily, a drop pit should be provided for driving wheels and supplemented as required by drop pits for engine truck, trailer, and tender wheels.

At points where considerable work is customarily performed on the wheels, the use of a drop table or unwheeling hoist should be considered.

Heating.—(a) Heat should be concentrated at the pits.

(b) The general temperature of the house should be kept between 50 and 60 deg. F.

*(c) The recommended method for heating houses of 10 stalls or over is by hot air driven by fans through permanent ducts located under the floors where practicable. The outlets should be located in the pits under the engine portion of the pits, and fitted with dampers to shut off the heat when necessary. Temperature of the hot air at the pits should be 130 to 150 deg. F.

The fan and distributing system should have a capacity for changing the air from 3 to 4 times an hour. The fresh air should be taken from outside the building. The fan intake should be so designed as to permit the use of all fresh air, all inside air, or part fresh and part inside air. A certain amount of recirculation, depending entirely on conditions, is permissible, particularly when the doors stand open for any length of time.

*(d) In a small house, or in a larger house in some climates, analysis may show the direct system of heating to be more desirable. In such a case, the vacuum return system should be used. Radiators should be placed in the pits and properly protected from falling parts, and also on the outer walls and end or fire walls. Radiators on the outer walls should be so located as to be clear of the path an engine would take in going through the outer wall.

Windows.—(a) The disadvantages of skylights are so much greater than their advantages as to make them undesirable.

*(b) Windows in the outer walls should be made as large as practicable with the largest glass or light area consistent with the strength of the structure. In general, the lower sill should be not more than four (4) ft. from the floor and the space between window frames and columns or pilasters and girders only that necessary to secure the window frames.

Windows in doors, when provided, should be furnished with wire glass.

***Electric Lighting.**—General distribution of illumination should be provided either by:

(a) Individual lights between pits arranged to avoid shadows, 300 to 500 watts to a stall, or;

(b) Flood lights on the outer and inner circle walls so arranged as to diffuse rays, eliminate the glare common with flood lights and avoid deep shadows. Usually two 100-watt lamps on the outer wall and one 60-watt lamp on the inner wall are sufficient.

Either system should be supplemented by plug outlets for drop cord lamps in each alternate space between pits.

Piping.—*(a) The engine house should be provided with piping for air, steam and water supply and for boiler blow-off. The latter line should discharge outside the house and when a boiler washout system is installed, should discharge into the blow-off reservoir.

*(b) A boiler washout and refilling system is ordinarily desirable to provide hot water for washing and refilling and to make use of the steam and water blown off from locomotive for this purpose.

*(c) The steam outlet should be located near the front end of the boiler. The blow-off line, the air, washout and refilling water and cold water connections should be near the front end of the fire box. Connections should be provided in alternate spaces between stalls, except for the blow-off line, to which connections should be provided between each stall.

*(d) Steam and hot water piping should be insulated.

***Machine and Tool Equipment.**—The space provided for machine tools and the extent of machine and tool equipment will depend entirely upon the location and method of operation of the house and must be made a subject of study for each house.

***Mechanical Handling Devices.**—Consideration should be given in the design of an engine house to the use of traveling cranes, jib cranes or monorails and provision made in the design of the structure for future installation if such is considered probable.

Appendix C—Engine Terminal Layouts

The committee presented a report, together with a plan of a typical engine terminal for a 30-stall engine house, indicating how it may be enlarged for the future, and suggesting that by a simple process of elimination, the terminal may be built for a twenty-stall or a ten-stall house. In arriving at the typical layout, the following assumptions controlled the committee's decision affecting the terminal layout:

(a) This is a division terminal not served by a back shop, but only where running repairs are made to about 150 locomotives daily.

(b) The terminal is situated near the throat of a freight yard and at a point near where power is released or returned to road service.

(c) In selecting a site, it is assumed that the terminal is within walking distance or at least a street car ride of an adequate supply of labor.

(d) Site to be selected after investigating the cost of real estate, restrictions by municipalities, ease of drainage, amount of grading and proximity of ample water supply.

(e) Trackage and other facilities are arranged, having in mind that the terminal will be called upon to clear from four to five locomotives per stall per day, and that the power may arrive in fleets at certain periods.

(f) It is assumed that in addition to the road power (passenger and freight) this terminal also serves a number of switching engines.

(g) No attempt has been made to fix the lengths of the inspection and ash pits, the capacity of the coaling station, the lengths of the turntable, the depth of the house, as these are subjects being handled by another sub-committee.

(h) Provision has been made for expanding the terminal capacity 100 per cent by adding to all facilities and by providing a second 30-stall house and a second turntable.

(i) The layout committee has been governed by the principle that it is not enough for an engine terminal layout and facilities to meet the normal demands, but if properly designed, it will function under the severest traffic and weather conditions.

Appendix D—Design of Car Shops

The committee made the following general comments and recommendations for the various subdivisions which make up a large passenger shop layout.

Coach Paint Shop.—The paint shop should be of fireproof construction, light, airy, roomy, free from dirt and dust, and should be well heated in cold weather. The tracks should be 25 ft. from center to center. The floor should be concrete and should pitch to floor drains to allow for scrubbings and quick drying after.

Traveling cranes and supply tracks are not needed. Permanent scaffolds should be provided. Ample space should be allotted for storing and mixing paints. Ample toilets, wash and locker rooms should be provided.

Coach Repair Shop.—The same width and track arrangement is recommended as for the paint shop. The building should be divided into two main bays, one on either side, with a center aisle about twenty feet wide in which should be installed a fifteen-ton traveling crane.

The floor should be wood block. Permanent scaffolds should be provided.

The shop should be piped for compressed air, steam, water and acetylene, and ample electric connections should be provided. A certain space should be set aside for tools and machinery. The pipe shop, air room and tin shop should be annexed to this building, if possible, as the greater portion of that work comes from and goes back to the cars while in this shop.

Wash House.—The committee recommended that a separate department be assigned and be properly equipped for washing cars. The wash house should be well lighted, heated and ventilated so the cars will dry quickly. It should have a concrete floor, properly pitched, with frequent floor drains to give good drainage. Scaffolds should also be provided and the shop should have water and steam connections.

Stripping and Trimming Shop.—The committee recommended provision for a place for stripping cars of sash, doors, upholstery and fixtures as they pass into the shops and another for trimming them as they go out with space in between where the parts removed can be repaired.

Truck Shop.—A separate truck shop should be provided according to a transverse arrangement, with room on each track for two sets of trucks. The building should have two main bays on either side and a narrow bay at the center with a ten-ton traveling crane. A longitudinal track should run the full length of the building to facilitate the handling of mounted wheels and axles.

Wheel and Axle Shop.—This shop should be conveniently located to both the freight and passenger repair shops. Large yard space is necessary in connection with this department for the storage of wheels and axles, both mounted and unmounted. Free movement of this operation is essential to economical production and great care should be exercised in laying it out. Monorails form the best method for serving this shop.

Blacksmith and Machine Shop.—These two shops are treated together because most of the work progresses through the smith shop into the machine shop to be finished. They should be very conveniently located with respect to the truck shop and easily accessible for the coach repair shop, as these two departments furnish practically all the work.

Wood Mill, Pattern and Cabinet Shops.—These three sections are closely related. All do wood work, and in the majority of layouts are combined under one roof and it is proper that they are. The mill should be conveniently located with respect to both passenger and freight car repair shops and should be so placed that ample yard and storage space is available for the storing of lumber. It should have as an accessory a dry kiln and large sheds for the storing of dried lumber.

Some means of disposing of sawdust and shavings must be provided. The preferable means of disposal is to bale for a commercial trade. If many patterns are to be made and stored, a separate fireproof storage should be provided.

Power Plant.—This involves a study in itself.

Discussion

(Chairman Morrow outlined the contents of the report and introduced G. H. Gilbert (Sou.), chairman of the sub-committee on Ash Pits, who presented the report on its subject, concluding with a *motion to adopt the committee's conclusions for inclusion in the Manual.*)

J. L. Campbell (E. P. & S. W.): Is the committee submitting this as information or statement of practice?

Mr. Gilbert: Both.

O. E. Selby (C. C. C. & St. L.): Without attempting to discredit the valuable work of the committee, I believe what they have submitted here is information and not recommended practice. I think the Manual would be better off without anything on the subject than to have something as general as this put in.

I move to amend the motion before the house by printing this as information in the Proceedings, and not in the Manual.

(*The amendment was carried.*)

(In the absence of Mr. Burpee, chairman of the sub-committee on engine houses, Mr. Kimball presented the report.)

L. P. Kimball (B. & O.): As a result of further study there is a recommendation for the replacement of the existing matter. (Appendix B.)

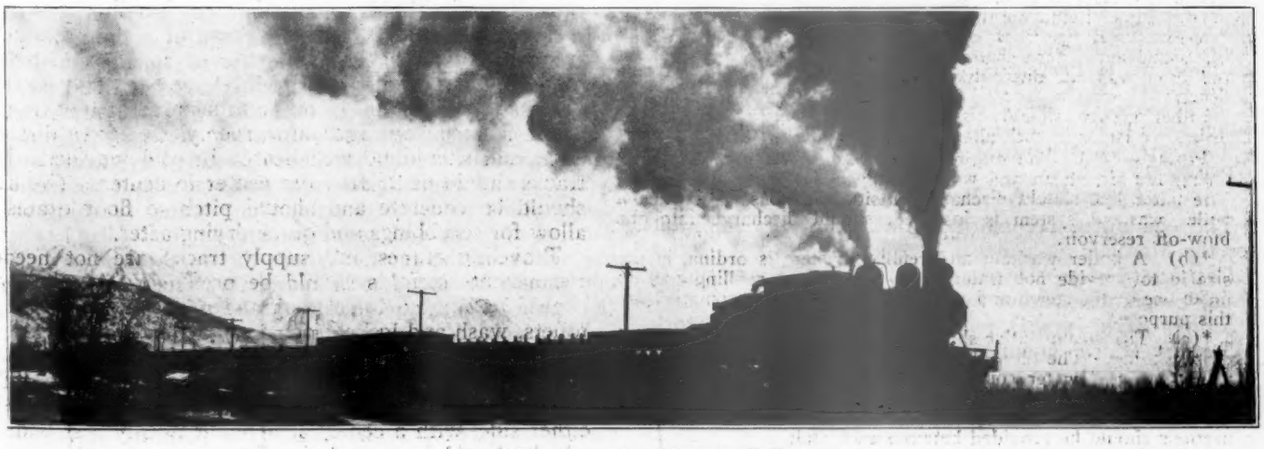
I move that this matter be accepted by the association and substituted for the present engine-house material in the Manual.

(*Motion carried.*)

Chairman Morrow: The work on engine house and power plants and shop extension was initiated in connection with our collaboration with the Mechanical section committee. This is presented simply as information.

This is followed by Appendix D, "Design of Car Shops," Report on Passenger Car Repair Shops. This is also presented as information.

The President: The convention will receive it as information. The committee is dismissed with the thanks of the association.



Coal Train on the Alaskan Railway

Report of Committee on Roadway

In the treatment of sliding cuts and fills as well as soft spots in excavations and embankments, all precautions should be taken to keep water away. Various methods designed to meet different conditions, but all based on the fact that the primary cause of slides is a lack of proper drainage, are submitted by the committee for inclusion in the Manual. Trestles should not be allowed to deteriorate too far before filling, otherwise serious difficulties will ensue. Drainage should be given careful attention, while allowance for probable future highways should be considered. Where possible, mechanical equipment should be used for ditching.

J. R. W. Ambrose
Chairman

J. R. W. Ambrose is a veteran in committee service, having been a member of the Roadway committee for twelve years. He is now rounding out his third year as chairman. Mr. Ambrose is chief engineer of the Toronto Terminal Railway Company, an organization created by the Canadian Pacific and the Canadian National railways to build and operate the new Union Station and adjacent terminal at Toronto. As a construction engineer of long experience Mr. Ambrose is in a position to appreciate the importance of drainage and the other problems of roadway construction and to direct studies leading to their solution in the future.

THE ACTION RECOMMENDED by the committee was:

1. That the definitions of terms under Revision of Manual (Appendix A) be approved for insertion in the Manual.
2. That the report on shrinkage and swell of grading material (Appendix B) be received as information.
3. That the conclusions in reference to methods employed and results secured in the treatment of sliding cuts and fills and soft spots in excavation and embankments (Appendix C) be approved and inserted in the Manual.
4. That a brief report on the effect of heavier power and increased tonnage upon roadbed previously considered stabilized be received as information.
5. That the report on filling of bridge openings (Appendix E) be received as information.
6. That the conclusions in the report on "Ditching" (Appendix F) be approved and inserted in the Manual.
7. That the report on chemical killing of weeds be received as information.
8. That a report on the design and use of reinforced concrete culvert pipe be received as information.
9. That a brief report on excessive cost of maintenance during the early period of operation be received as information.

Committee: J. R. W. Ambrose (Toronto Term.), chairman; C. M. McVay (K. & M.), vice-chairman; H. G. Aylesworth (C. B. & Q.), E. W. Bayer (C. C. C. & St. L.), C. W. Brown (L. & N. E.), H. W. Brown (Penna.), R. K. Brown (S. L. & U.), A. S. Butterworth (G. F. & A.), C. C. Cunningham (C. R. I. & P.), W. C. Curd (Cons. Engr.), C. A. Daley (Erie), S. B. Fisher (M. K. & T.), R. D. Garner (S. N. E.), R. C. Gowdy (C. & S.), F. M. Graham (Penna.), H. Hawgood (Cons. Engr.), E. G. Hewson (G. T.), W. H. Jaekle (S. F.), A. A. Matthews, W. H. Penfield (C. M. & St. P.), P. Petri (B. & O.), Frank Ringer (M. K. & T.), H. A. Roberts (O. W. R. R. & N.), R. B. Robinson (U. P.), R. A. Rutledge (A. T. & S. F.), G. L. Sitton (Sou.), E. G. Taber (S. I. R.), H. E. Tyrrell (Sou.), C. E. Weaver (C. of Ga.), W. H. Woodbury (D. & I. R.), J. C. Wrenshall (P. & R.).

Appendix A—Revision of Manual

The committee recommends the following definitions for the Manual:

Casting (verb).—Disposing of excavated material by a single operation either by hand or machinery.

Station Men (noun).—Men engaged in station work.

Station Work (noun).—A small piece of grading work extending over one or more stations.

Appendix B—Shrinkage and Swell of Grading Material

Considerable correspondence has been carried on by the sub-committee and additional information requested from various sources, but very little has been received that would add to what has already been reported. The committee found nothing that would lead it to change any conclusions previously made as to this subject. No further density tests have been reported and there is nothing to add to the report of a year ago in this regard. It is hoped that some of the railroads will do more with this matter in the ensuing year. The committee again recommended that the subject be closed until additional investigation and experiments are available on this subject.

Appendix C—Methods Employed and Results Secured in the Treatment of Sliding Cuts and Fills and Soft Spots in Excavations and Embankments

Surface slides occur in nearly every class of material and combination or mixture of materials, except rock, in both excavations and embankments and are caused largely by the ground becoming saturated. The extra weight of the water in the ground upsets the equilibrium and reduces the cohesion and a slide is the result. In northern climates the action of frost greatly facilitates the action of the water by opening up crevices and making the ground porous.

Treatment in Excavations.—Surface water should be kept from the face of cuts as much as possible by the use of intercepting ditches constructed well back from the top of cut. These ditches should be constructed with care and should be well maintained so as not to let pockets form to hold water that will eventually soak into the ground and may be the cause of a slide.

Where cuts have a large number of springs on their surface, small concealed tile drains have been laid down the slopes to the ditches in order to keep the water from the numerous springs and saturating the soil. In many cases excellent results have been obtained by facing cuts with layer of engine cinders or fine slag about six inches deep. This tends to distribute any water reaching the face of the cut and prevents cutting, and also lessens the action of the frost. Where this method is used the cut should be faced to a reasonably true plane before the application of the coating.

In cities and towns sodding of slopes has been carried out with good success, but on account of the cost, this method of treatment has been confined mostly to densely inhabited districts where the esthetic value of this method is given consideration. The planting of vegetation (not trees) on the slopes of cuts has proven very successful in the cure of slides.

Embankments.—Small slides of embankments are treated in practically the same manner as above mentioned in cuts except for the drainage. The slopes have been sodded and faced with cinders in a manner similar to the treatment of cuts and with equal success. The flattening of the slope and the weighing of the toe of the slope with derrick rip rap where it is practical to do so, and where the toe of the slope is subject to the action of running or standing water, has proven successful.

In low-lying country where there is a large amount of surface and ground water, considerable trouble has been experienced in holding fills. To overcome this ditches have been dug near the right-of-way line some distance from the toe of the slope and the ground water level lowered with exceedingly good results. The depth of the ditches to be dug depends on the fall that can be obtained.

Slides or slips of great volume are hard to remedy. Each case must be studied and the cause determined, if possible, and this cause then removed. In nearly every case it is underground water or seepage that causes the trouble.

When a study has been made of the movement and its cause determined it is generally found that the slipping occurs on a stratum of inclined rock or clay. Sometimes the stratum of clay is only an inch or so thick. Water reaching the stratum of rock or clay is retained and forms a lubricant which upsets the equilibrium of the mass and the slide starts. The remedy is, of course, to intercept the water and to prevent it following the strata.

In many cases where the volume of the slip amounts to several thousand yards, the movement has been stopped by the use of concrete retaining walls, or pile bulkheads. A concrete retaining wall can be used only where a good foundation is procurable and its use is, therefore, considerably limited. In many cases, pile bulkheads have been the correct solution.

Soft Spots.—Soft spots in excavations and embankments, the origin of which is the result of geological formation, are hard to contend with and no uniform treatment can be applied to all cases. A method that has been successfully used in both excavations and embankments is the use of long ties. One of the railroads in the northwest reports an effective method of treatment by the construction of a reinforced concrete slab 12 in. thick, on which the track is carried. The foundation for the concrete slab is prepared by leveling off the sub-grade and applying a 12-in. layer of good engine cinders. The cinders furnish good drainage and the concrete slab distributes the load uniformly.

In some cases soft spots in cuts have been treated by driving piles along the ballast line with the idea of confining the material, and by driving pile butts from 6 to 12 ft. in length spaced from 3 to 4 ft. directly under each rail and sinking them 2 or 3 ft. below sub-grade. The latter method is reported as being more satisfactory. An effective method reported in the treatment of soft spots under embankments is the widening of the embankment until a point is reached where the pressure, due to the load, is distributed over a very large area.

Conclusions

The committee recommends the substitution of the following conclusions for those published in the new Manual, as follows:

(1) The primary cause of slides is the lack of proper drainage.

(2) In the construction of a new line when conditions indicative of future trouble with soft spots or slides are encountered, special attention to the diversion of the springs or streams which are likely to cause the trouble should be given.

(Change the numbers of Conclusions 1 to 9, inclusive, now in the Manual.)

(3) Conclusion 10. Facing the slopes with a coating of engine cinders or fine slag will prevent small slides.

Soft Spots.—Where soft spots cannot be effectively drained the bearing area of the track structure must be increased.

Definition of Soft Spot.—Soft spots are small areas in excavation or embankment, or the sub-soil under an embankment, saturated with water and having a relatively small supporting power.

Appendix E—Filling of Bridge Openings

A preliminary investigation must develop especially: The size of culvert necessary, which will generally govern the type of culvert to be used. The character of foundation available for the culvert. The character of foundation for the new fill.

The condition of the moisture with regard to withstanding the stresses incident to filling and carrying traffic at the same time; for if a trestle is allowed to deteriorate too far before filling, serious difficulties will be encountered in keeping the structure safe for traffic during the progress of filling. The availability and quality of material for making the fill, as both will affect the first cost, and the latter the future maintenance of the fill.

Whether or not the advantage of widening adjacent cuts from which the filling material may be excavated will by improved drainage and increased snow room justify this method of procedure as against getting all the material from one place.

Consideration should be given to the necessity of providing undergrade crossings to accommodate future as well as existing highways. Elimination of fire hazard by reason of filling wooden trestles should be taken into consideration.

Construction of Fill and Care of Structure During Filling

Before starting to construct the fill, see if there are any springs in the area covered, and if so, build concrete boxes over them and pipe the water beyond the limit of the new fill. Where rock is available and fall is sufficient, french drains may be substituted for the pipe. In certain sections of the country where trestles are to be filled in marsh land, it is frequently found advantageous to lay a grillage consisting of a double layer of small tree trunks.

With wooden trestles, before starting a new fill, the trestle must be carefully gone over and put in shape to stand the stresses incident to filling.

In the case of iron and steel viaducts which are usually of greater height than wooden structures, precautions must be taken to prevent distortion of the columns. This can be accomplished by encasing the columns in reinforced concrete up to a point within 20 ft. of base of rail, or where there is no danger from fire satisfactory results have been obtained by the erection of intermediate wooden bents at suitable intervals in order to reduce the load upon the towers.

As the filling of the viaduct proceeds, all bracing, both longitudinal and transverse, should be cut loose from the bents as the fill reaches the connection points, for this bracing transfers a great deal of load to the bents, which increases the settlement and has a tendency to work the viaduct out of line. Vertical bracing need only be cut loose at the upper connection points.

Where foundation is good, and in case of low trestles, where it is not good, fills can be made by dumping directly from the structure to be filled. Good results may be obtained by use of a ditching machine in conjunction

with two 16-yd. air dump cars for jobs of approximately 5,000 cu. yd. or less, and by steam shovel and air dump cars for jobs of over 5,000 cu. yd., though this dividing line is by no means fixed, as it depends on the haul, the depth of cuts from which material is available, and the relative need for ditching the cuts in the vicinity of the structure.

Before dumping from the trestle, the wooden guard timbers should be removed and plank about 2 in. by 2 in. should be spiked on top of the ties, close to the rail, to prevent the ties from bunching. This applies to side dumping. When center dumping is employed, the same method may be followed by cutting out alternate ties between the inside line of the stringers.

When filling high trestles where the foundation is very bad and liable to give trouble due to settlement, and traffic may be sufficiently heavy to justify it, it may be advisable to build temporary trestles on each side of the main trestle, and located so that material dumped from them will spread to cover the area of the completed fill. The use of grab buckets from a cable way or the use of an endless belt conveyor may be employed to advantage in making fills of this character. Then by dumping simultaneously from all three trestles, or dumping simultaneously from the main trestle and cable ways, the settlement may be reduced and kept fairly uniform.

It is often advisable to haul filling material further, in order to obtain a better grade of material to stabilize the fill and reduce the cost of future maintenance.

Immediately after the completion of the filling of low trestles, the stringers should be removed, but in cases of high trestles, the stringers should not be removed until the fill has settled about all it will without the load of trains; except that, if trestle has become so badly out of line and surface that it cannot be resurfaced and relined, it is better to remove the stringers at once and put the load on the green fill, even if this requires considerable watching and resurfacing of track for some time.

Appendix F—Ditching

Ditching on different railroads is done under many varying conditions; using practically the same method, the unit costs for work of like character vary about as follows:

Casting	$0.42 to	$1.00	per cu. yd.
Company forces with wheelbarrow or push cars	.50 to	1.95	per cu. yd.
Spreader car	.09 to	.175	per cu. yd.
Ditching machine	.04 to	.722	per cu. yd.
Teams and scrapers	.50 to	1.37	per cu. yd.

These figures may have some significance, but are of little value in drawing conclusions without a complete statement of the conditions under which each job was done.

Good roadbed drainage is the foundation of economical track maintenance; therefore, the ditching of cuts is of great importance and should be carried out currently with the regular yearly maintenance program.

Ditching, in ordinary material, may be subdivided into two principal classes:

Class "A"—Cuts not more than six feet deep in average open counter.

Class "B"—Cuts more than six feet deep.

Class "A"—Cuts Less Than Six Feet Deep

Company forces: On lines where traffic is heavy and ditching is done currently the work can usually be done economically by company forces, the material being cast out of the cut and leveled back so as to prevent it from washing down into the ditches.

Contract forces; station men; teams and scrapers: These methods are found to be economical on lines of heavy traffic where, on account of deferred maintenance or nature of material, the volume to be handled is large.

Spreader cars equipped with wings for shaping ballast shoulders, roadbed shoulders, ditches and slopes: These machines may be used to advantage on lines of moderate traffic in ordinary material, but their use is not recommended on heavy traffic, single track, lines with frequent trains; nor is the use of other ditching machines recommended under similar conditions.

Class "B"—Cuts More Than Six Feet Deep

Company forces provided with push cars and dump beds, wheelbarrows or trackbarrows. Loading and hauling out: This method will be found to be economical on heavy traffic lines, and also on lines with moderate traffic, where ditching machines are not available, or where the volume of material to be handled would not justify their use.

The use of work trains with hand labor is generally uneconomic, and is not recommended.

Teams and scrapers on yardage basis: Where the character of material is suitable, and the volume to be handled comparatively large, teams and scrapers may be used to advantage under unit cost contract provided the cuts are of sufficient width to permit of safe operation.

Auxiliary track and small cars: This method may be used economically on heavy traffic lines where operating tracks cannot be interfered with and where there is sufficient clearance, provided the haul is long and volume of material to be handled would justify the initial cost of the plant installation.

Ditching Machines

The use of steam ditchers and their equipment is recommended in work where the cuts are long and deep, or where the volume of material to be moved is great; or where the material is wet and difficult to handle by other methods. Their use is also recommended where cuts are resloped or widened to such a limited extent as *not* to justify the use of steam shovel. Under similar conditions they may be used for widening embankments. They are particularly efficient in removing small slides or other like emergencies where material is wet or hard to handle.

Locomotive cranes equipped with clam-shell buckets of 1 to 1½ cu. yd. capacity can be used successfully in cleaning out cut ditches where it is desirable not to disturb the slopes and will produce a ditch of uniform width and depth without handling surplus material or requiring any redressing by hand.

Where, on account of long haul in disposing of material, it is necessary to load many cars before dumping, ditching equipment is recommended which will operate over a series of flat cars with a proper mechanical device or plow for unloading.

There may be isolated cases where it is economical to use scoop ditches, but it is believed the steam ditcher or the locomotive crane will accomplish the same results with a greater flexibility.

Work incidental to ditching such as shaping roadbed and ballast shoulders is primarily hand work after the major work of ditching is complete, but by the use of spreader cars with proper attachments this work may be done at a cost that is comparatively very low and their use is recommended for these purposes when the nature of material will permit and where traffic conditions are not such as to prohibit such interference.

Discussion

Chairman Ambrose: The first subject is Revision of the Manual under Appendix A. *I move that these be approved and placed in the Manual.*

(*Motion carried.*)

(The subject, Shrinkage and Swell of Grading Material, Appendix B, was presented by the sub-committee chairman, C. M. McVay (K. & M.) and was accepted as information.)

Edwin F. Wendt: Before that subject is passed I note that in the text your committee have expressed a desire that further consideration of shrinkage and swell of grading material be discontinued at least temporarily. I trust that the committee will not press that request, and that the Board of Direction and the Committee on Outline of Work will continue this subject. The subject is one of much more importance than is generally understood. The committee states that there is no real information on this subject. It seems to me that is a very good reason why the committee should constantly be looking for added and reliable data.

The President: Your suggestion will be given consideration by the Committee in Outline of Work.

(The matter on Appendix C, "Methods Employed and Results Secured in the Treatment of Sliding Cuts and Fills and Soft Spots in Excavations and Embankment," was presented by C. H. Daley, chairman of the sub-committee.)

Chairman Ambrose: *I move that the conclusions in Appendix C be adopted and placed in the Manual as read.*

(*Motion carried.*)

(The subject relating to the filling of bridge openings was presented by J. C. Wrenshall (P. & R.)

Mr. Wrenshall: It is the thought of the sub-committee that this report dealing with the physical character of the work should be continued with advantage and amplified by a consideration of the economics of fillings, and I would like to see the committee continued along those lines. *I therefore move that the report be received as information and published in the Proceedings of the association.*

(*Motion carried.*)

Chairman Ambrose: Mr. Wrenshall's committee in reality has prepared a specification. I think that the information in this report will form the basis for a perfectly good specification for bridge filling.

(In the absence of H. E. Tyrrel, chairman of the sub-committee on Ditching, Appendix F, this report was presented by F. Ringer (M. K. & T.)

Chairman Ambrose: *I move that these conclusions be approved and placed in the Manual.*

C. A. Morse (C. R. I. & P.): I would like to hear some discussion with reference to the use of spreader cars equipped with wings for shaping ballast shoulders, roadbed shoulders, ditches and slopes.

R. H. Ford (C. R. I. & P.): Mechanical ditching as a part of the regular program, and on heavy and light traffic lines, has become a factor from which we cannot get away. There is no reason why a mechanical ditcher cannot be used on lines of all classes of traffic. There is no justification for spending our money on maintenance by hand ditching. It should be all done mechanically, and mechanical means have been developed for the purpose, irrespective of the traffic on the lines. The Rock Island is ditching at the rate of about twenty-five miles a day with ditching machines. With reference to the height of the cuts, I think that point is open to some question, but I did not take exception to it. The feature Mr. Morse raises is very pertinent. The density of the traffic does not interfere.

Chairman Ambrose: Perhaps Mr. Morse was a little misled. If you will notice, you are quoting on the section under shallow cuts.

Mr. Ford: I want to make it plain that it does not make any difference whether it is a shallow cut or a deep cut. Ditching can be done better by mechanical means irrespective of the size or depth of the cut or of the density of traffic.

Mr. Ringer: I do not think the sub-committee could agree with Mr. Ford that the density of traffic is not a factor in the cost of ditching. I think it is just the reverse. The recommendation will not tend to increase the use of the spreader car and ditching equipment on modern traffic.

Mr. Ford: I hope the convention will be willing to require the committee to take this subject under further considertion next year. I have no objection to the first definition and its conclusion.

J. A. Stocker (T. & O. C.): I agree with Mr. Ford. I think it is a mistake in this report not to put more emphasis on mechanical ditching and less on hand ditching. We use mechanical ditchers for depths less than 6 ft. I think we use them for ditching 6 in. deep.

Chairman Ambrose: The committee's idea is based on economy, and we are for mechanical ditching just so long as it spells economy. If we find we can ditch by hand for less money than otherwise, we prefer that.

J. V. Hanna (K. C. T.): I would like to ask whether the committee has any actual cost figures to support its claim that there are times when hand work is economical.

Mr. Ringer: One answer to that is the fact that it is being done.

Mr. Hanna: I want to ask Mr. Ford if he has included in hand work the use of teams?

Mr. Ford: No, I excluded teams. We had a case on one division on spreader work where there was a difference of over $200,000 as to team work done one year and the complete elimination the second year. *I want to ask that the motion for the approval of this report be confirmed only to the first paragraph under conclusions, and that all others be referred back to the committee.*

J. V. Neubert (N. Y. C.): I would like to ask Mr. Ford how he is going to handle it in rock cuts?

Mr. Ford: The first thing to do is to get enough rock out so that some means can be taken mechanically to remove it.

W. H. Penfield (C. M. & St. P.): In listening to Mr. Ford it occurred to me that he is only talking of one class of ditching machines. The committee, before preparing any conclusion or recommendation, went into the matter thoroughly, and they outlined here some of the machines that were recommended as being in use on the various railroads in the country. The spreader cars that Mr. Ford speaks of are comparatively new in the bulk of the railroads, and I think the questionnaire that we sent out brought out replies from but a few railroads that were familiar with them; at least, the replies would indicate that they had not been used to any extent. I was in thorough accord with the committee's conclusions or recommendations, and I think that that was borne out by what little data we could get as to the cost of ditching.

R. G. Kenly (M. & St. L.): I would like to suggest the last paragraph under class A the committee consider eliminating the last three lines, from the word "but." We have had exactly the same experience as the Rock Island, not in such an extensive way probably, but the spreader car has come to stay.

The President: Will that satisfy you, Mr. Ford?

Mr. Ford: It will satisfy me this way, that it leaves the report without any punch in it, and it seems to me that what the committee ought to do is to take it back, because seriously it represents one of the greatest opportunities for saving, it is one of the places where we can get some money. This committee ought to come

back next year with a report, which is a good one, and take the other back for a year and give it some study.

(*Mr. Ford's amendment was carried.*)

The President: Now we have reached the motion to print the first paragraph in the Manual.

(*Motion carried.*)

(S. B. Fisher (M. K. & T.) presented the report of the sub-committee on "Chemical killing of weeds on and removal of killed weeds from the roadbed.)

The President: This is to be received as information. Any discussion? If not, we will pass to the next.

(W. C. Curd, chairman of the sub-committee on design and use of reinforced concrete pipe, next reported and his report was received as information.)

(The excessive cost of maintenance during the early period of operation was presented by C. C. Cunningham (C. R. I. & P.), chairman of the sub-committee, and it was received as information.)

Mr. Wendt: I note that this subject is entitled "The excessive cost of maintenance." I would like to suggest to the committee as well as to the Board that the word "excessive" gives rise to a very false understanding. I would suggest that the word "excess" be eliminated because it gives rise to a false understanding.

Mr. Ray: The committee used the word excessive, where the instructions said excess. It makes quite a little difference.

Chairman Ambrose: We stand corrected.

(The committee is dismissed with the thanks of the association.)

Report on Records and Accounts

The forms for recording data for keeping up to date records of property changes and valuation of railroads which were submitted as information last year were presented again and recommended for inclusion in the Manual. It was the opinion of the committee that the electric wiring symbols adopted by the National Electrical Contractors' Association and the American Institute of Architects should be adopted. The study on the feasibility of reporting railway engineering data in graphic form will be continued as well as the study of the feasibility of reducing the number of forms used in the engineering and maintenance of way departments.

H. M. Stout
Chairman

H. M. Stout, who is completing his second year as chairman and his eighth year as a member of the committee, is record engineer of the Northern Pacific. He is therefore in a position to appreciate the value of records to an extent not commonly found among engineers and to realize their present limitations and short-comings. At the present time there is need for more complete and accurate records to meet the demands of regulating authorities and valuation officers, and this committee can do much constructive work. From his long contact with the problems on which the committee is working Mr. Stout is peculiarly qualified to direct its work on constructive lines.

THE COMMITTEE submitted a number of proposed changes in the Manual in Appendix A. A progress report was submitted on cost-keeping methods and statistical records and also on forms for recording data for keeping up to date records of property changes and valuation of railroads. In Appendix D the committee submitted a report on conventional signs for architectural details.

Conclusions

1. The committee recommended that changes in the Manual, as submitted in Appendix A, be approved and the revised matter be substituted for the present subject-matter in the Manual.

2. The committee reported progress on the subject of cost-keeping methods and statistical records, and recommended that it be reassigned.

3. The committee submitted three forms, shown here as Exhibits A, B, and C, revisions of those offered last year, and recommended their adoption and publication in the Manual. The committee recommended the continuation of the subject.

4. The committee has under study the subject of the feasibility of reporting engineering data in graphic form and recommended that it be reassigned.

5. The committee reported progress on the subject of the feasibility of reducing the number of forms used in the engineering and maintenance of way departments, combining forms and simplifying those retained, and recommended that it be reassigned.

6. The committee recommended the adoption and publication in the Manual of the electrical symbols given under Exhibit D and that a set of architectural symbols be accepted as information and the subject continued.

7. The committee reported progress and recommended reassignment of the subject of methods for recording and accounting for the determination of proper allowances for maintenance of way expenses due to increased use and increased investment.

Committee: H. M. Stout (N. P.), chairman; Henry Lehn (N. Y. C.), vice-chairman; A. M. Blanchard (G. T.), H. Bortin (Cons. Engr.), H. A. Campbell, Armstrong Chinn (C. B. & Q.), R. A. Cook (C. & A.), E. B. Crane (C. M. & St. P.), E. B. Fithian (M. P.), J. H. Milburn (B. & O.), W. F. Ogle (C. R. I. & P.), H. J. Sargent (Wabash), H. F. Sharpley (C. of Ga.), Chas. Silliman (Pres. Conf. Comm.), C. W. Simpson (D. L. & W.), T. H. Strate (C. M. & St. P.), W. A. VanHook, V. R. Walling (C. & W. I.), W. D. Wiggins (Penna.).

Appendix A—Revision of Manual—Definitions

Account (present text)—A statement required to enable payment to be made for labor performed and material furnished or to establish the detail, total and comparative cost of work and various classes of expenses.

Account (revision)—A statement required to enable payment to be made for labor performed, material furnished or to establish the detail, and total cost of work or class of expense.

Ledger Accounts (present text)—Statement kept in ledger form in order to establish the detail, total and comparative cost of individual pieces of work or classes of expenses.

Ledger Account (revision)—An account of an individual piece of work or class of expense kept in ledger form.

Appendix C—Forms for Recording Data for Keeping Up to Date Property Changes and Valuation of Property of Railroads

Three forms which were submitted to the association last year as information were presented again as Exhibits A, B, and C, and were recommended for adoption.

Appendix D—Conventional Signs for Architectural Details

Electrical wiring symbols, designated as Exhibit D, and which have been adopted by the National Electrical Contractors' Association and the American Institute of Architects, were submitted and it was the opinion of the sub-committee that these symbols should be approved and adopted.

Discussion

(Chairman Stout abstracted the report and *moved that the revised definitions be accepted and substituted for those appearing in the Manual.*)

E. F. Wendt (Con. Engr.): The definitions which now appear in the Manual have been there for over 15 years. They were formulated very largely by the late Walter E. Berg, chief engineer of the Lehigh Valley, than whom there was no greater authority on definitions. When they were adopted they were thought to be as near perfect as they could be made. I would like to have the committee explain what difference there is between the definitions now in the Manual and the proposed revised ones.

(Chairman Stout gave a brief explanation of changes made.)

(*Motion carried.*)

(E. B. Crane (C. M. & St. P.) presented the matter under Appendix C.)

Chairman Stout: *I move that the three forms referred to, together with the specifications and instructions, be accepted and published in the Manual.* (*Motion carried.*)

Chairman Stout: *I move that the electrical symbols shown in Exhibit D be accepted and published in the Manual.*

(*Motion carried.*)

(The architectural symbols under Exhibit E were received as information and the committee was excused with thanks.)

Report on Uniform General Contract Forms

Some revisions in the Manual are submitted to secure uniformity and to coordinate certain matters in relation to specifications for roadway which were compiled before the organization of the Committee on Uniform General Contract Forms. A recommendation is made that the two committees concerned revise the specifications so that the "General Conditions" of the specifications now included in the Manual may be omitted and in the future be covered by the General Conditions of the construction contract forms. A Form of License for Wires, Pipes, Conduits and Drains on Railroad Property was submitted for inclusion in the Manual.

W. D. Faucette
Chairman

W. D. Faucette is finishing his second year as chairman of the committee, of which he has been a member for six years. He has been in the continuous service of the Seaboard Air Line since 1901 and has been chief engineer since January 1, 1913, prior to which time he was an assistant engineer and later for three years chief clerk to the president. In directing the work of this committee he has done much to stimulate interest in what is commonly regarded as an uninteresting subject. He represented the association in a recent meeting called by the Associated General Contractors at Washington to consider a uniform contract form.

In Appendix A, covering revision of the Manual, certain changes were recommended for adoption by the association. In Appendix B was submitted the final draft of a "Form of License for Wires, Pipes, Conduits and Drains on Railroad Property," which was recommended for approval and insertion in the Manual. An agreement for private road crossing was submitted in tentative form in an appendix.

Conclusions

(1) The committee recommended the changes in the Manual as set forth in Appendix A be adopted and that the Committee on Roadway be requested to make the revisions referred to in Appendix A.

(2) The committee recommended "Form of License for Wires, Pipes, Conduits and Drains on Railroad Property," printed in Appendix B, adopted and printed in the Manual.

(3) The committee recommended that the report in its Appendix C on "Form of License for Private Road Crossings" be received as information, with the request that any criticism and suggestions be given this committee in order that a final report may be made next year.

Committee: W. D. Faucette (S. A. L.), chairman; C. A. Wilson (Cons. Engr.), vice-chairman; C. F. Allen (M. I. T.), J. C. Irwin (B. & A.), C. B. Niehaus (C. of Ga.), O. K. Morgan (C. C. & O.), H. A. Palmer (G. T.), C. J. Parker (N. Y. C.), E. L. Taylor (N. Y. N. H. & H.), Frank Taylor (C. P. R.), A. C. Shields (C. R. I. & P.), J. B. Carothers (B. & O.), W. H. Brameld (Erie), W. A. Duff (C. N. R.), F. H. Fechtig (A. C. L.), Clark Dillenbeck (P. & R.).

Appendix A—Revision of Manual

Proposed Revisions to the Manual—"Form of Construction Contract," Section 38, "Final Estimates," page 665:

(1) It was recommended that the word "whole" be omitted from the second line, as indicated below:

Upon the completion and acceptance of the work, the Chief Engineer shall execute a certificate over his signature that the *whole* work provided for in this agreement has been completed and accepted by him under the terms and conditions thereof, whereupon the entire balance found to be due to the Contractor, including said retained percentage, shall be paid to the Contractor at the office of the Treasurer of the Company within ..... days after the date of said final certificate.

(2) As regards the use of the word "railway" and the word "railroad" in the Manual, for uniformity it is

recommended that hereafter the word "*Railway*" shall be used in all forms and specifications, and when the Manual is reprinted wherever the word "railroad" occurs it shall be changed to "*Railway.*"

(3) "Specifications in the Manual in connection with which any uniform general contract form would or should be used."

It has been found that the Specifications for Roadway were compiled before the organization of the Committee on General Contract Forms, and included therein general conditions for the construction of such roadway and stated in these conditions that the Specifications and General Conditions formed the entire agreement. The committee recommended that the Committee on Roadway and the Committee on Uniform General Contract Forms be requested to revise the Specifications for Roadway so that the "General Conditions" of the Specifications as now printed in the Manual be omitted from the Specifications and covered by the General Conditions of the Construction Contract Form.

Appendix B—Form of License for Wires, Pipes, Conduits and Drains on Railway Property

THIS AGREEMENT, made this ..... day of ..... 19...., by and between the ....., hereinafter called the Railway Company, and ....., having a principal office or place of business in ..... hereinafter called the Licensee, WITNESSETH;

WHEREAS, the Licensee desires to construct, maintain and use ..... upon the property of the Railway Company, situated....., and substantially as shown on the plan hereto attached, designated as ....., dated ....., and made a part hereof:

It is mutually agreed as follows:

1. The Railway Company grants permission to the Licensee to construct, maintain and use ..... upon the property of the Railway Company, in accordance with said plan and the specifications forming a part hereof, and subject to the requirements of the Railway Company.

2. In consideration of this license, the Licensee shall pay to the Railway Company, in advance, the sum of..... per ..... beginning .....

3. Every cost and expense of construction, maintenance, use and removal resulting from this license, shall be paid by the Licensee. The Railway Company may perform, without notice, any work which it considers necessary to the safe operation of the railroad. The Licensee shall do no work under this license, which may interfere with the operation of the railroad without the written permission of the Railway Company.

4. Use of the property of the Railway Company, however long continued, shall not create any estate or easement in the Licensee or any rights other than license.

5. The License shall idemnify, protect, and save harmless, the Railway Company from and against all claims, suits, costs, charges, and damages, made upon or incurred by the Railway Company in connection with this license.

6. This agreement may be terminated by either party by ..... notice to the other party, or without notice on disuse by the Licensee for.....

7. Any notice given by the Railway Company to the Licensee shall be deemed to be properly served if the notice be delivered to the Licensee, or if left with any responsible agent of the Licensee, or if mailed, postpaid, addressed to the Licensee at the last known place of business of the Licensee.

8. Upon termination hereof the Licensee shall forthwith remove all the Licensee's constructions from the property of the Railway Company, to the satisfaction of the Railway Company. In case of the Licensee's failure so to do, the Railway Company may at its option either retain such construction or remove them at the cost of the Licensee.

9. This agreement shall not be assigned or in any manner transferred, without the written consent of the..... of the Railway Company.

10. Until terminated as hereinbefore provided, this agreement shall inure to the benefit of and be binding upon the legal representatives and successors of the parties, respectively.

IN WITNESS WHEREOF, the parties hereto have executed this agreement on the day and year first above written.

WITNESS.....

.....

RAILWAY COMPANY.

WITNESS.....

.....

LICENSEE.

By.....

Discussion

(The report on Uniform General Contract Forms was presented by W. D. Faucette (C. M. & St. P.). Appendix A was presented and adopted for inclusion in the Manual.)

(Chairman Faucette then abstracted Appendix B and said:) There seems to be a great deal of difference among ourselves as to a proper liability clause in this tentative report, and we were unable to come to any final conclusion. In this connection it is proper to say that this committee has been in contact with the American Railway Development Association and will report to you next year what we have developed.

Chairman Faucette: Mr. Irwin will present the report on "Form of License for Wires, Pipes, Conduits and Drains on Railway Property."

J. C. Irwin (B. & A.) then abstracted the report.)

Chairman Faucette: *I move that the proposed form be adopted and printed in the Manual.*

Hunter McDonald: I assume of course that this committee has been in touch with the Committee on Electricity. Are you satisfied there will be no objection raised by that committee?

Mr. Irwin: This committee has conferred with the Committee on Electricity and the Committee on Roadway and they are in agrement with it.

(*Motion carried.*)

Mr. Irwin: The further work of the sub-committee consists of a typical form of agreement for trackage rights, which is based on agreements of 34 roads throughout the United States and Canada, and we have started on the preparation of such a typical form and propose to present it next year.

(The committee was then excused.)

Report on Economics of Railway Location

THE COMMITTEE has studied the effect of curvature on cost of maintenance of way and equipment and has reached the conclusion that it is difficult to present information on this subject that would be of practical value. It would be possible to work out results for a larger number of factors after extended research, tests and experiments; but the practical value of such results would be doubtful. For these reasons, it was the recommendation of the committee that this subject be dropped.

The sub-committee assigned to the subject of Railway Locomotive Power is making a study of locomotive tractive effort and the various processes proposed for predicting tractive effort at various speeds, in the expectation of revising the present section on "power" in the Manual, where necessary. This work could not be completed in time for presentation with this report. It was therefore recommended that the subject be continued for the ensuing year.

Committee: A. S. Going (G. T.), chairman; H. R. Carpenter (M. P.), vice-chairman; F. H. Alfred (P. M.), R. N. Begien (B. & O.), C. T. Delamere (C. P. R.), W. A. James (C. P. R.),

Fred Lavis (Cons. Engr.), E. C. Schmidt (U. S. A.), A. K. Shurtleff (A. R. E. A.), C. W. Stark (N. Y. N. J. Com.), Walter Loring Webb (Cons. Engr.), M. A. Zook (I. C. C.), Willard Beahan (N. Y. C.), J. C. Beye, A. S. Cutler (Univ. of Minn.), E. E. King (Univ. of Ill.), E. H. McHenry, H. C. Searls, C. H. Splitstone (Erie), J. G. Sullivan (Cons. Engr.), J. W. Walter.

Discussion

The report of the Committee on Economics of Railway Location was presented by A. S. Going, Engineer of Construction of the Grand Trunk and was considered as a progress report.

Report of Committee on Water Service

Attention is called to the regulations directing the notification of health authorities of water supply points, ownership of sources and other details. The enforcement of provisions of the Interstate Quarantine Regulations prohibiting the contact of ice with water for drinking purposes has been set forward to July 1, 1924. Local deposits are an important factor to be considered in relation to the pollution of surface and shallow well water supplies. A questionnaire sent out for the purpose of securing data on the pitting and corrosion of boiler tubes and sheets brought out some interesting replies on the possible causes and their remedies.

A. F. Dorley
Chairman

A. F. Dorley is the dean of the committee chairmen of the Association, as he is rounding out his ninth year in this position. He has been a member of the committee for eleven years. Mr. Dorley is district engineer on the eastern lines of the Missouri Pacific, prior to which time he was engineer of water service for a number of years. He has given close attention to water treatment and was instrumental in the launching of an extensive program of this character on his road several years ago. Under his leadership the committee has done much to stimulate interest in this important but too frequently neglected phase of railway operation.

THE COMMITTEE requested the following action on its report:

(1) That the definitions given be approved and inserted in the Manual; and that the subject of examination of the subject-matter in the Manual be again referred to the committee for further study and report.

(2) That the report on progress of drinking water regulations be received as information and that the subject be reassigned to the committee for further study and report.

(3) That the subject of specifications for contracting water service work be reassigned to the committee for further study and report.

(4) That the final report on effect of local deposits on the pollution of surface and shallow well water supplies be received as information.

(5) That the progress report on the study of pitting and corrosion of boiler tubes and sheets be received as information, and that the subject be reassigned to the committee for further study and report.

(6) That the report on specifications for the various chemicals used in water treatment be adopted and published in the Manual.

(7) That the report on centrifugal pumps for railway water service be received as information.

(8) That the specifications of the American Water Works Association covering cast iron pipe and special castings, and hydrants and valves be adopted and published in the Manual.

(9) That certain reference to work of interest to railway water supply being done at universities be accepted as information.

Appendix A—Revision of Manual

Due to an oversight, the following definition for a continuous treating plant was omitted last year:

Continuous Plant.—"One so designed that the untreated water may be pumped to it without interruption and where the volume of the chambers through which it passes before flowing to storage is sufficient for complete chemical reaction and precipitation."

The committee added the following explanatory note at the bottom of Table 2, shown on page 450 of the 1915 Manual:

"Table is based on use of calcium oxide or lump lime. To obtain equivalent value for hydrated lime, multiply lime value shown in table by 1.32."

Under definitions published in Volume 21 for insertion in the new Manual, the following corrections have been made: Group A, third item, eighth and twenty-second words, "strainer" to read "screen," to conform with the sixth item.

Considering the definitions, the word "penstock" has been eliminated in question 23, under "Examination Questions for the Care of Boilers."

The committee recommended the following additions and changes in the new Manual:

Under Definitions of Terms used in Railway Water Service, Group G, are definitions for single and double-acting pumps. The following definition for a double-stroke pump should be added:

Double-Stroke Deep Well Pump.—One that employs two separate balanced lines of pump rods and attached water pistons. The two lines of pump rods and their respective pistons alternate with each other in such a way that the weight, or load, lifted by each rod is carried only in its tension, or upstroke.

Alkali Water.—A term in common use, meaning water containing in solution any compound of sodium or potassium in appreciable amounts.

Corrosion.—The eating away of the surface of metal by chemical action, either regularly and slowly as by rusting in air, or irregularly and rapidly as by pitting and grooving in the interior of boilers.

Appendix B—Federal or State Regulations Pertaining to Drinking Water Supplies

The Interstate Quarantine Regulations and Standard Railway Sanitary Code furnish full information on subjects pertaining to railway sanitation and laws governing same and is recommended to the notice of all concerned. The committee desires to call attention to the regulations

directing the notification of health authorities as to the location of the water supply points and ownership of sources, this to be done twice yearly with proper certification and permission of the surgeon general for use of water on interstate carriers. The posting of signs forbidding the use of water considered unsafe for public use is now done by federal or state health authorities and notice is signed either by the United States Public Health Service, or the state health authorities or both, thus relieving the railroads of this responsibility. The collection of water samples from indicated sources of supply is performed in most of the states by state health authorities, the iced containers being shipped by the railroads to the state laboratories for analysis. The examination is usually without cost to the railroad.

Section 19, Subdivision (d), Interstate Quarantine Regulation, provides that drinking water shall be handled in such a manner as not to impair its sanitary quality or safety and already surveys have been made by state and federal health authorities tending towards betterment in methods of handling now being followed, their recommendations being directed toward the cleanliness of drinking water coolers, containers used in carrying water from source to coolers, and directing that ice shall not come in contact with water. This latter provision, it will be noted, is not in accordance with an already existing provision that properly handled ice shall not necessarily be kept separated from water until July 1, 1922, and in accordance with recently received information contained in Circular No. 2131, Medical and Surgical Section, American Railway Association, and dated March 7, 1921, an enforced separation of ice and water has been postponed until July 1, 1924.

Instructions are also given that containers shall be cleaned once each week and that storage tanks shall be flushed and drained once a month; hose used in filling containers shall have a protected metal nozzle kept clean by flushing and washing.

Circular No. 2140 of the American Railway Association contains, among other matters, a letter written by Assistant Surgeon General McLaughlin, "that if permission to use water is given a community by the state having jurisdiction the use of such water by a carrier should be permitted." This brings up the question of temporary provisional certification, which is for water not fully approved by reason of a by-pass in the water system, connection with impure water supply for emergency use, unsatisfactory operation or similar reasons, the intent and purpose of such certification being to give opportunity for advised and needed repairs or improvements. This matter was taken up with the United States Public Health Service and it was stated that a ruling covering provisional certification would be contained in the revised edition Interstate Quarantine Regulations, which, however, was omitted.

The appointment of a joint committee from the Medical and Surgical Section, also the Mechanical Section, of the American Railway Association and from the Water Service committee of the American Railway Engineering Association, is looked upon as a valuable forward step in the splendid efforts which the railroads are putting forth to give the public their best, in service, in equipment and in courtesy, and the resultant action is looked forward to by all.

Appendix D—A Report on the Pitting and Corrosion of Boiler Tubes and Sheets

It cannot be expected that the committee can find the solution of this problem in a short space of time and this report is submitted as a progress report only. The following questionnaire prepared at a committee meeting in Chicago on May 6, 1921, was sent to all members of the sub-committee and replies were received from nine of the eleven members:

(1) *What In Your Experience Have Been the Causes of Corrosion?*

The experience of the committee indicates that *general* corrosion is prevalent where acid waters, or waters with a high percentage of chloride or sulphate hardness are used without treatment.

(2) *What In Your Experience Has Been the Cause of Pitting?*

The replies indicate that pitting in locomotive boilers results from electrolytic action, the underlying causes of the electrolytic action being due to chemical or mechanical action or both.

The presence in the water of an electrolyte such as sodium sulphate or sodium chloride is necessary in sufficient quantities to convey the electric current between spots of impurities in the material which have different potentials, thereby resulting in a wasting of the metal at the negative pole. The presence of dissolved oxygen in the water materially assists the electrolytic action by removing the corrosion by-products and allowing the destructive action to continue.

(3) *What In Your Experience Has Been the Cause of Grooving?*

The causes of grooving are also ascribed to electrolytic action. The strained metal of a boiler plate that is not completely covered by a rivet head becomes eaten away or perhaps a plate becomes strained at a point by temperature stress, and the strained streak is corroded. In each case the strained metal is of greater corrosibility and it acts as one of the plates of an electric battery, in which the other plate of the battery is the unstrained metal of the boiler shell and the electrolyte is the water in the boiler.

(4) *What Is Your Method of Prevention?*

To date efforts toward prevention of corrosion, pitting and grooving have been chiefly confined to chemical treatment of the water. No means of complete prevention have as yet been found although in actual practice the trouble has been very materially decreased on some railroads by maintaining a caustic alkalinity in the boilers which appears to have an inhibitive effect on the corrosive action. Apparently, little work has been done toward improving the character of boiler materials and methods of handling with a view to securing a more homogenous material and eliminating strains and stresses which appear to be responsible in part at least for much of the grooving, ring pitting and similar forms of corrosion.

(5) *Have You Laboratory Tests Confirming Specific Causes of Corrosion, Pitting and Grooving?*

Laboratory tests were reported which indicated that pitting takes place in commercial boiler steel immersed in water very readily where oxygen and carbon dioxide are present and is accentuated by increased amounts of sodium sulphate or sodium chloride and also by higher difference of potential with an increased rate of electrolysis. It is also shown that this action is inhibited to a considerable extent by the addition of sodium carbonate or caustic soda. Other tests were presented which strongly indicated the presence of spots of impurities which had been rolled into the material and made up into flues.

(6) *Have You Any Laboratory Tests to Suggest to Confirm Your Findings or That Would Be of Assistance In the Study of This Subject?*

Inasmuch as it has been found in practice, that treatment with caustic soda inhibits to a greater or lesser extent the pitting action, it is suggested that during the coming year careful tests be made to determine the minimum and maximum effective limit of caustic soda treatment with special relation to varying concentrations of sodium sulphate and sodium chloride, these being the principal electrolytes found in boiler waters.

This subject in general is intimately connected with departments other than engineering and it is respectfully suggested that the Board of Direction request that a committee be appointed from the mechanical section to work in coöperation with this committee, so that all phases including the manufacture and fabrication of material may be considered as well as the character of the water supply.

Appendix E—Specifications for Various Chemicals Used in Water Treatment

Standard Specifications for Soda Ash to Be Used in Water Treatment

Definition.—1. Soda ash is the anhydrous normal carbonate of soda.

Classes.—2. Soda ash is commercially divided into two classes:

(a) Light; (b) Dense.

3. Dense soda ash shall be rejected.

(I) Chemical Properties and Tests

Sampling.—4. The samples shall be a fair average of the shipment, and shall be taken from the surface to the center of package.

The vendor shall take a one pound sample from four packages in various locations in each carload or less and forward to the purchaser. The sample, on receipt by the purchaser, shall be immediately transferred to air-tight containers in which the unused portion shall be stored until the soda ash has been finally accepted or rejected by the purchaser.

Check tests on samples taken from cars at their destination will occasionally be made, and should agree within reasonable limits with initial sample.

Chemical Properties.—5. (a) The classes and properties of soda ash shall be determined by standard methods of chemical analysis.

(b) Soda ash shall conform to the following requirements as to chemical composition:

Normal sodium carbonate—95 per cent minimum.

(II) Physical Properties and Tests

6. The material shall be in dry powdered form and shall be free from lint, chips, ash or other foreign matter.

Fineness.—7. A 100-gram sample shall not have more than 0.5 per cent by weight, insoluble in cold distilled water.

(III) Packing and Marketing

Packing.—9. Soda ash shall be packed in cloth or duck bags of not more than 100 lb. net weight, or in paper bags of not more than 50 lb. net weight.

Marking.—10. The name of manufacturer and net weight shall be plainly marked on each package, or attached by tag thereto.

(IV) Inspection, Penalization and Rejection

Inspection.—11. (a) All soda ash shall be subjected to inspection.

(b) The soda ash may be inspected at the place of manufacture or point of delivery, or both, as arranged at the time of purchase.

(c) The inspector representing the purchaser shall have free entry at all times, while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the soda ash ordered. The manufacturer shall afford the inspector all reasonable facilities for inspection and sampling, which shall be so conducted as not to interfere unnecessarily with the operation of the works.

(d) The purchaser may make the tests to govern the acceptance, penalization or rejection of the soda ash in his own laboratory or elsewhere, Such tests, however, shall be made at the expense of the purchaser.

Penalization.—12. All prices shall be based upon the percentage of normal sodium carbonate. If a lower grade is furnished than the one specified, provided it is not less than 80 per cent sodium carbonate, it may be accepted by the purchaser upon the vendor making a rebate equal to percentage of sodium carbonate below the minimum designated.

Rejection.—13. (a) Unless otherwise specified, any rejection based on failure to pass tests prescribed in these specifications shall be reported within 10 working days from the taking or receipt of samples by the purchaser.

(b) Rejected soda ash shall be returned to the shipper or as he may direct. All freight charges in both directions to be paid by the shipper.

Rehearing.—14. Samples which represent rejected soda ash shall be preserved in air-tight containers for 10 working days from the date of test report. In case of dissatisfaction with the result of the tests, the manufacturer may make claim for a rehearing within that time.

Standard Specifications for Hydrated Lime to Be Used in Water Treatment

Definition.—1. Hydrated lime is a dry flocculent powder resulting from the hydration of quicklime.

Classes.—2. Hydrated lime for water treatment is commercially divided into two classes:

(a) High-Calcium;

(b) Calcium.

Basis of Purchase.—3. The particular class of hydrated lime desired shall be specified in advance by the purchaser. Unless otherwise specified high-calcium lime shall be furnished.

(I) Chemical Properties and Tests

Sampling.—4. The sample shall be a fair average of the shipment. Three per cent of the packages shall be sampled. The sample shall be taken from the surface to the center of the package. A 2-lb. sample to be sent to the laboratory shall immediately be transferred to an air-tight container, in which the unused portion shall be stored until the hydrated lime has been finally accepted or rejected by the purchaser. Check tests on samples taken from cars at their destination will occasionally be made, and should agree within reasonable limits with initial sample.

Chemical Properties.—5. (a) The classes and chemical properties of hydrated lime shall be determined by standard methods of chemical analysis.

(b) The hydrated lime shall conform to the following requirements as to chemical composition:

High Calcium—Not less than 90 per cent Calcium Hydroxide ($Ca(OH)_2$).

Calcium—Not less than 85 per cent Calcium Hydroxide ($Ca(OH)_2$).

(II) Physical Properties and Tests

Fineness.—6. A 100-gram sample shall leave by weight a residue of not over 2 per cent on a standard 100-mesh sieve and not over 0.5 per cent on a standard 20-mesh sieve.

(Note—Paragraphs covering Packing and Marking; and Inspection, Penalization and Rejection, are all the same as given for soda ash.)

Standard Specifications for Quicklime to Be Used in Water Treatment

Definition.—1. Quicklime for use in water treatment is a material the major part of which is calcium oxide, which will slake on the addition of water.

Grades.—2. Quicklime is divided into two grades:

(a) Selected.—Shall be well-burned, picked free from ashes, coke, clinker or other foreign material.

(b) Run-of-Kiln.—Shall be well-burned, without selection. It shall be free from large lumps of unburned or foreign material.

Forms.—3. Quicklime is shipped in two forms: (a) Lump—shall be kiln size. (b) Pulverized—shall be reduced in size to pass a ¼-in. screen.

Classes.—4. Quicklime for water treatment is divided into two classes: (a) high calcium, (b) calcium.

Basis of Purchase.—5. The particular grade, form and class of quicklime desired shall be specified in advance by the purchaser. Unless otherwise specified, high-calcium quicklime shall be furnished.

(I) Chemical Properties and Tests

Lime in Barrels.—6. Quicklime shall be shipped in barrels, or other containers of similar size. At least 3 per cent of the number of barrels shall be sampled. They shall be taken from various parts of the shipment, dumped, mixed and sampled. The samples shall comprise at least 10 shovelsful taken from different parts of the shipment. The total sample taken shall weigh at least 100 lb. and shall be crushed to pass a 1-in. ring, and quartered to provide a 15-lb. sample for the laboratory.

Laboratory Samples.—7. All samples to be sent to the laboratory shall be immediately transferred to an air-tight container in which the unused portion shall be stored until the quicklime shall finally be accepted or rejected by the purchaser.

Check tests on samples taken from car at destination will

occasionally be made, and should agree within reasonable limits with initial sample.

(B) Chemical Tests

Chemical Properties.—8. (a) The classes and chemical properties of quicklime shall be determined by standard methods of chemical analysis.

(b) Samples shall be taken as specified in sections 6 and 7.

(c) Quicklime shall conform to the following requirements as to chemical composition:

Chemical Composition

Properties Considered	High-Calcium		Calcium	
	Selected	Run-of-Kiln	Selected	Run-of-Kiln
Calcium Oxide, per cent.....	90 (min.)	90 (min.)	85-90	85-90
Calcium Oxide plus Magnesium Oxide, min., per cent.....	90	85	90	85
Carbon Dioxide, max., per cent.	3	5	3	5
Silica plus Alumina plus Oxide of Iron, max., per cent.....	5	7.5	5	7.5

(II) Inspection, Penalization and Rejection

(Same as for soda ash.)

Standard Specifications for Sulphate of Alumina to Be Used in Water Treatment

Definition.—1. This chemical shall be the commercial product known as Basic Sulphate of Alumina.

(I) Chemical Proportion and Tests

Sampling.—2. The sample shall be a fair average of the shipment. Five per cent of the packages shall be sampled. The sample shall be taken from the surface to the center of the package. A five-pound sample shall be sent immediately to the laboratory and transferred to an air-tight container in which the unused portion shall be stored until the alumina has been finally accepted or rejected by the purchaser.

Check tests on samples taken from cars at their destination will occasionally be made, and should agree within reasonable limits with initial sample.

Chemical Properties.—3. (a) The chemical proportion of basic sulphate of alumina shall be determined by standard methods of chemical analysis.

(b) Basic sulphate of alumina shall contain not less than 17 per cent water soluble aluminum oxide (Al_2O_3); 3 per cent by weight of the aluminum oxide shall be in excess of the theoretical amount required to combine with the sulphuric acid present.

(II) Physical Properties and Tests

4. The material shall be in dry lump form and shall be free from lint, chips, ash or other foreign matter.

(III) Packing and Marking

5. Basic sulphate of alumina shall be packed in cloth or duck bags of not more than 50 lb. net weight, or in barrels or containers of not more than 300 lb. net weight.

6. The name of manufacturer, net weight and percentage of water soluble alumina shall be plainly stencilled on each end of package or marked on tag securely attached thereto.

(IV) Inspection, Penalization and Rejection

(Same as for soda ash.)

Standard Specifications for Sulphate of Iron to Be Used in Water Treatment

Definition.—1. Sulphate of iron is the ferrous sulphate, the theoretical formula of which is $FeSO_4 + 7H_2O$.

Classes.—2. Sulphate of iron commercially does not have exactly seven molecules of water combined with one molecule of anhydrous ferrous sulphate.

3. Commercially there are three grades:

(a) Prime green, selects, or stick crystals.

(b) Seconds or bottoms.

(c) Granular or sugar sulphate of iron.

(I) Chemical Properties and Tests

Sampling.—4. The samples shall be a fair average of the shipment and shall be taken from the surface to center of each package.

Ten one-pound samples shall be taken from packages in various locations in each carload or less. These samples shall be thoroughly mixed, and then quartered. One-quarter shall then be placed in an air-tight container and submitted to the purchaser's laboratory for tests.

Check tests on samples taken from cars at their destination will occasionally be made, and should agree within reasonable limits with initial sample.

Chemical Properties.—5. (a) The chemical properties of the material shall be determined by standard methods of analysis, and the shipments shall conform to the following minimum requirements:

(b) Impurities: Not over 2 per cent.

(c) Anhydrous ferrous sulphate $FeSO_4$: Not less than 53.5 per cent.

(d) Free Sulphuric Acid: Not over .025 per cent.

(II) Physical Properties and Tests

Physical Properties.—6. Shipments of seconds or bottoms shall be rejected. Either Grade (a) or Grade (c) shall be furnished as specified on the purchase order. Unless otherwise specified, Grade (c) shall be furnished.

(III) Packing and Marking

Packing.—7. Sulphate of iron shall be packed in cloth or duck bags of not more than 100 lb. net weight, or in barrels or containers of not more than 250 lb. net weight as specified in purchase order.

Marking.—8. The name of the manufacturer, net weight and grade of sulphate of iron shall be stencilled on each package, or marked on tag securely attached thereto.

(IV) Inspection and Rejection

(Same as for soda ash.)

Appendix G—Standards

During the past year the committee gave careful consideration to the adoption of standard specifications covering cast iron water pipe and special castings, and standard specifications for hydrants and valves. The conclusion reached was that the standard specifications of the American Water Works Association were complete in every detail and so well established that practically all cast iron pipe specials, valves and hydrants now used by railroads were furnished under these specifications. Therefore, upon the recommendation of the Standardization committee, the Board of Direction instructed the committee to present these specifications to the Association for approval.

The specifications are Standards for Cast Iron Water Pipe (adopted by the American Water Works Association May 12, 1908) and Standards for Hydrants and Valves (adopted by the American Water Works Association June 24, 1912. Revised June 9, 1916).

Discussion

(In the absence of Chairman Darley through illness, C. R. Knowles (I. C.) presented the report. Mr. Knowles abstracted Appendix A appertaining to the revision of Manual and moved that the report be accepted, which motion was carried.) Mr. Knowles then presented in their turn, Appendix B, on federal or state regulations pertaining to water supplies; Appendix C, appertaining to the effect of local deposits in pollution of surface and shallow well water supplies; and Appendix I, appertaining to studies on pitting and corrosion, all of which were accepted either as information or a report of progress.

Mr. Knowles then abstracted Appendix E, appertaining to the specifications for soda ash in water treatment and *moved that the specification be approved for publication in the Manual.* The motion was carried. Mr. Knowles then abstracted Appendix F, appertaining to centrifugal pumps and *moved that this be accepted as information. Motion carried.*

Mr. Campbell (E. P. & S. W.): In our experience we find the centrifugal pump a very useful and economical means of lifting water in reasonable limits, up to 200 ft. We have one installation in which we are lifting water 400 ft., but we are not finding that economical, and we are now proposing to take that out and substitute another style of pump.

(Mr. Knowles abstracted Appendix G and *moved that these specifications be adopted for publication in the Manual.)*

The President: May I ask if the American Water-

works Association collaborated with your committee when these standards were adopted?

Mr. Knowles: They did not. They gave us permission to use them.

C. E. Lindsay (N. Y. C.): Will the committee consent to substitute the word "specification" for the word "standards" in the large heavy type "Specifications for cast iron water pipes" and "specifications for hydrants and valves"?

Mr. Knowles: The committee will accept that.

Mr. Lindsay: Also omit "standard" from the word "specifications" following.

Mr. Knowles: The committee will be glad to accept that.

(*Motion carried.*)

(Mr. Knowles abstracted an Appendix appertaining to the university work of interest to railway water supply, and said:) It is the desire of the committee to coöperate with the universities in the study of this work, so that the results will be consistent, and not in conflict with actual practice and experience. This report is submitted as information.

D. A. Steel (*Railway Age*): Concerning the review made by the committee of the work done by me at the University of Montana in 1920, I do not want to convey the impression of criticizing this review, because I am very grateful to know that the committee saw fit to take notice of the work, and I realize that in making the review the sole desire was to bring out the interest on the part of the universities throughout the country to cooperate with the railways in solving this problem, but I am afraid that some of the phraseology in this review might have a damaging effect on the value of the report. Take, for instance, the words "electroylic phaze" in the statement of the review, "An investigation of interest in connection with the study of the electroylic phaze of pitting and corrosion was carried on." I think the inference which would be drawn by almost anyone in reading this casually would be that the committee referred to the report as a brief for a definite school of thought on this subject. On the contrary, the work involved no underlying intention of supporting any one school of thought, simply to bring forth some very patent observations in connection with the corrosion, so that all parties concerned might appreciate the nature of it.

Mr. Knowles: The objections raised by Mr. Steel do not seem to be very serious, and I think with his explanation included, it will be clear to all who read it.

I know it was Mr. Dorley's intention to make a few comments on water service, and in his absence I have a few remarks which, with your permission, I will present to the convention.

(Mr. Knowles then presented the following:)

A water supply, ample in quantity and of satisfactory quality, is one of the essential requirements for the successful operation of a steam railroad. A survey of the field in this country indicates that a conservative estimate of the annual water consumption on American railroads is approximately nine hundred billion gallons. In the neighborhood of 14,000 water stations are required to supply this amount of water, involving a very large initial investment. The annual expenditure for operation and maintenance is in excess of $100,000,000. While this figure represents an important item of expense in railroad operation, it is small in comparison to the expense involved from the effect on locomotive upkeep and operation, caused by use of unsatisfactory or inadequate supplies, and the time will come when the extravagance of water waste and scale in boilers will not be tolerated.

There appears to have been but little progress in the development of suitable organization to handle this important feature of railroad operation. It is a significant fact that where special attention has been given this subject, very satisfactory economies have been effected, together with improvement of the property and power. It is therefore desired to call the attention of the members of the association to the possibilities of the water service organization as approved last year for publication in the Manual of recommended practice.

(The committee was excused with thanks.)

Report on Signs, Fences and Crossings

A questionnaire sent to the railroads in regard to the location of signs did not disclose any laws or orders of public utility commissions which conflict with or vary much from the recommendations in the report of the committee. Wherever possible a uniform distance for all signs from the center of the track is better than variable distances for different classes of signs although a uniform distance will require the widening of the roadbed at the location of the sign on fills. A total of 17 substitutes for wood crossing planks were grouped in five classes, installations of most of which have been in service too short a time to offer any definite conclusions.

Maro Johnson
Chairman

Maro Johnson is rounding out his first year as chairman of the committee after serving as vice-chairman for one year. He has been a member of the committee for eight years. He is an assistant engineer on the staff of the bridge engineer of the Illinois Central, in which capacity he was in charge of the construction of the St. Charles Air Line bridge with its 260-ft. bascule span across the Chicago river at Chicago, which was placed in service about a year ago. As a member of this committee he has been active in the preparation of standard designs for roadway signs and in the promotion of uniform practices in their installation.

THE COMMITTEE SUBMITTED A REPORT on the location of roadway signs in Appendix A. A report on substitutes for crossing planks was presented as information in Appendix B.

In Appendix C were presented tentative specifications for all concrete posts and tentative plans for round and square line posts.

Conclusions

The committee recommended that the statement in Appendix A relating to the location of signs be adopted and printed in the Manual.

Committee: Maro Johnson (I. C.), chairman; T. E. Rust (W. C. F. & N.), vice-chairman; Anton Anderson (C. I. & L.), Arthur Anderson (N. Y. C.), F. D. Batchellor (B. & O.),

C. H. N. Connell (C. N.), A. Crumpton (G. T.), L. B. Curtis (N. P.), A. Daniels (C. M. & St. P.), G. N. Edmondson (N. Y. C.), W. J. Harris (C. B. & Q.), R. A. Harry, S. C. Jump (I. C.), L. C. Lawton (A. T. & S. F.), O. H. Sessions (G. T.), S. E. Shoup (K. C. S.), W. C. Swartout (M. P.), R. L. Turner (Erie), W. D. Warren (N. Y. N. H. & H.), K. G. Williams (Union).

Appendix A—Location of Signs

In studying the location of signs, the committee sent a circular to a large number of railroads asking for information as to their general practice in locating signs, with the purpose of finding out if there were any unusual conditions which should be taken into consideration, also with the idea of avoiding a recommendation that would vary too much from present practice. The information obtained included the location of signs with relation to the track; location with relation to the objects affected, and details of local, state, or public service commission laws or orders applying to the location of signs.

Summary of Replies to Questionnaire

Distances from the track: The replies to the questionnaire show considerable variation in the distances used, but the majority are less than recommended in this report.

Distances along track, from the object affected: In most instances, the sign itself indicates the location. Where it does not, varying locations are given in the replies.

Laws or orders of public utilities commissions: These affect primarily highway crossings, drawbridges and whistle posts. The questionnaire does not disclose any law or order which will conflict with, or vary much, from the recommendations of this report. If such variations do occur, the law, of course, will govern.

Safety and clearance are naturally combined. This association has previously adopted a clearance diagram applying to bridges requiring horizontal clearance of eight feet from the center of the track and signs should not encroach on this.

The committee believes it would generally be better to adopt a uniform distance for all signs wherever possible rather than vary it for different classes of signs, the main consideration being safety for employees, which is controlled by distance from the track.

Roadbed width may also be considered important; by roadbed width we mean the width of sub-grade. Even with the widest roadbed now in use, based on this information, it would be necessary, in order to get good clearance from the track, to build out the shoulder properly to support signs located on embankments.

Clearance required for snow plow wings, roadbed spreaders and weed destroyers which are used on practically all railroads has been investigated and we believe that sufficient clearance has been provided for this equipment.

The committee recommended the distances given on a table of signs submitted with its report, appreciating the fact that widening of the roadbed on fills will be necessary, and further, that this is the practice in vogue on railroads at the present time where signs are located at a sufficient distance from the track to require it.

Appendix B—Substitutes for Wood Crossing Planks

In 1913 this committee submitted a report on "Track Construction and Flangeways at Paved Street Crossings and in Paved Streets," which applied more particularly to crossings constructed of the same material as the adjoining street. The present preliminary report is more general and includes all kinds of crossings.

In recent years the high price of wood crossing plank has resulted in the introduction of a number of substitutes, of which 17, if paving blocks are included, have come to the attention of this committee. These may be grouped in five classes in accordance with the material of their construction. So classified, these substitutes are listed below. The figures under the group headings indicate the number of crossings of that group included in this report.

Concrete	(a)	Solid Concrete.
21	(b)	Precast slab.
	(c)	Concrete plank.
Bituminous Material	(a)	Tarvia.
57	(b)	Headley Good Roads Oil.
	(c)	Emulsified Asphalt.
	(d)	Kentucky Rock Asphalt.
	(e)	Sheet Asphalt.
	(f)	Paving Pitch.
Steel or Iron	(a)	Innus Armco Iron Highway Crossing.
3	(b)	Jennings Steel Crossing.
	(c)	Railroad Rails.
Paving Blocks	(a)	Granite.
8	(b)	Brick.
	(c)	Wood.
Ballast Material	(a)	Gravel.
1	(b)	Disintegrated Granite.

For the most part, these crossings have been in use but a short time, and definite conclusions as to maintenance cost and serviceability cannot be reached. A number of roads, however, in addition to those reported on, are giving consideration to the adoption of one or the other of the substitutes.

Briefly summarized, the status of each group is as follows:

Solid Concrete—We do not find many crossings of this type, and, where used, they have been on tracks where there is little railroad traffic.

Precast Concrete Slab—This type of crossing has been used on a number of railroads, though of varying design. Most of the installations have been made subsequent to 1919, so that they have hardly been in service long enough to obtain information as to their durability and cost of maintenance. One thing that has been demonstrated is that when concrete slabs are placed, crossings should have good drainage to prevent heaving in winter time.

Concrete Plank—The C. B. & Q. has tried out a number of these crossings. The main trouble seems to be that the upper corners of the concrete plank disintegrate under service, indicating that such plank should have some sort of corner protection.

Bituminous Materials—There are more crossings of this type in service than any of the others. The first cost of installation is lower and they are easily installed.

Steel or Iron, Plate Type—This type of crossing is not used extensively and seems to be in an experimental stage. One of these was installed in 1918, on the C. C. C. & St. L., at Seventy-first street, Carthage, Ohio. After 17 or 18 months it was taken up on account of the plates not being heavy enough to carry the trucks which passed over them. These crossings are now being made of heavier material. One will be installed on the B. & O. at Cincinnati, Ohio. There seems to be a tendency for horsedrawn vehicles to avoid this type of crossing when possible.

Railroad Rails, Steel or Iron—These crossings consist of rails laid between the running rails, and spaces filled in with concrete or other material. They have not been used in high speed tracks.

Paving Blocks—This type of crossing is used mostly

in cities and particularly where the adjacent street is paved with blocks or where ordinances require their use.

Ballast Material—Crossings of this type seem to be used mostly at farm crossings, and on highways with light traffic.

Appendix C—Specifications for Concrete Fence Posts

(I) Materials

1. **Intent.** The intent of these specifications and the plans of which they form a part is to produce concrete fence posts having a uniform and sufficient strength and durability at a minimum of cost. On account of the thinness of the section, this can only be accomplished by intelligent and constant attention to securing proper proportions of all ingredients.

2. **Cement.** Cement shall conform to the present Standard Specifications and Tests for Portland Cement of the American Railway Engineering Association and subsequent revisions thereof.

3. **Fine Aggregate.** Fine aggregate shall consist of sand, stone screenings, or a combination thereof, having clean, hard, strong, durable, uncoated grains, and free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. It shall range in size from fine to coarse, preferably within the following limits:

Passing through a No. 4 sieve	not less than 95%
Passing through a No. 50 sieve	not more than 30%
Weight removed by decantation	not more than 3%

4. **Coarse aggregate.** Coarse aggregate shall consist of crushed stone, gravel, or combination thereof, having clean, hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, organic or other deleterious matter. It shall range in size from fine to coarse within the following limits:

Passing a ½" screen	not less than 95%
Passing a No. 4 screen	not more than 15%
Passing a No. 8 screen	not more than 5%

5. **Bank Gravel.** Natural combinations of fine and coarse aggregate, in the form of bank gravel, may be used providing its particles meet all the requirements in paragraphs 2 and 3 above, and provided such particles are properly graded from fine to coarse within the following limits:

Passing a ½" screen	not less than 95%
Passing a ¼" screen	from 35% to 55%
Passing a No. 50 screen	not more than 15%
Weight removed by decantation	not more than 1½%

6. **Water.** Water for concrete shall be clean and free from oil, acid, alkali, organic or other deleterious substance.

7. **Metal Reinforcement.** Steel reinforcement shall be hard steel and shall conform to the present Standard Specifications for Steel Reinforcement of the American Railway Engineering Association or, if wire is used, to the present Tentative Specifications for Cold-Drawn Steel Wire of the American Society for Testing Materials, or to such modifications of either of such specifications as may hereafter be adopted by the American Railway Engineering Association. Reinforcement shall be in the form of round or square bars, preferably deformed, or steel wires. Crimped, stranded or flat reinforcing shall not be used. Reinforcing, before being placed in the molds, shall be thoroughly cleaned of mill and rust scale, and of coating that will destroy or reduce the bond.

(II) Proportioning and Mixing Concrete

8. **Proportioning.** The unit of measure shall be the cubic foot. One bag of Portland cement shall be considered as one cubic foot. Each of the constituent materials shall be measured separately by volume, using a method which will secure the specified proportions. The water shall be measured by an automatic device that will secure the same quantity in successive batches.

9. **Strength.** The proportion of cement, water and aggregate shall be such as to produce a concrete having a compressive strength at 28 days of 2,000 lb. per sq. in. The proportions of fine and coarse aggregate to produce such a concrete shall be determined by making a screen analysis of the available aggregates and using such a mixture as will secure a maximum density. To such a mixture sufficient cement shall then be added to produce concrete of the desired strength. If bank gravel is used it shall be screened and remixed, if necessary in order to produce concrete of the desired strength, or if such screening and remixing will produce concrete of the desired strength with enough less cement so that the saving in the cost of cement will exceed the cost of screening and remixing.

10. **Consistency.** No more water shall be used than is necessary to produce a concrete which can be worked thoroughly into the forms and around the reinforcing. The consistency shall be measured by the slump test in the method described in the 1921 report of the Committee on Masonry, American Railway Engineering Association. The maximum slump shall not exceed six inches. The consistency shall be checked up from time to time.

11. **Mixing.** Mixing shall be done in a batch mixer of approved type, equipped with a suitable charging hopper, water storage, and water measuring device. The entire contents of the drum shall be discharged before recharging. Each batch shall be mixed for not less than 1½ min. after all the materials are in the mixer, during which time the mixer shall rotate at a peripheral speed of about 200 ft. per min. The volume of the mixed batch shall not exceed the manufacturer's rated capacity. The retempering of concrete which has partially hardened shall not be permitted. In cold weather aggregate shall be heated, if necessary, to remove frost and frozen lumps.

(III) Depositing Concrete

12. **General.** Before depositing concrete the molds shall be thoroughly cleaned and coated with non-staining mineral oil or other approved material. The mixer should be so located that the concrete can be discharged directly into the molds or conveyed to the molds in such a manner as to cause no separation of the ingredients. Each mold shall be completely filled in one continuous operation.

13. **Molds.** Molds shall be substantial, rigid, and true to plan. Metal molds are more satisfactory than wooden molds.

14. **Placing Reinforcing.** The reinforcing shall be securely and continuously held in its proper position in the post during the placing of the concrete and until the post is removed from the mold. Metal spacers that would cause distinct lines of cleavage in the post shall not be used. The reinforcing shall be supported as often as is necessary to prevent its sagging to any appreciable extent due to its own weight or to the weight of the wet concrete.

15. **Compacting.** Concrete shall be thoroughly compacted into the molds and around the reinforcing. This is best accomplished by giving the molds a jogging or vibratory motion during and after depositing.

16. **Finish.** All posts shall have a clean, smooth finish. If any pockets or holes are discovered upon removal from the molds, they shall be immediately filled with a mixture of one part cement to two parts fine aggregate. Pockets or holes more than ½ in. in depth or more than ½ in. in diameter, or any exposure of the reinforcing shall cause the rejection of the post.

(IV) Curing and Handling Posts

17. **Curing.** The posts shall remain in the molds until the concrete has thoroughly hardened and in no event for less than 24 hours after placing. During this time and until they are cured the posts shall be carefully handled and protected from shock. When the posts are removed they shall be stocked in a nearby vertical position and protected from direct sunlight. They shall be kept wet by sprinkling for eight or ten days after being made. They should be cured for not less than 90 days, when cured naturally, before being shipped or set. Posts shall not be cured out of doors during freezing weather.

(V) Miscellaneous

18. **Inspection.** All materials and all processes of manufacture shall be subject to inspection and approval at all times. Free access shall be provided for all authorized inspectors to all parts of the plant in which the posts or the materials are made, stored or prepared.

19. **Tests.** All testing of materials used in the manufacture of posts, all preparing, storing and testing of concrete specimens, as provided in Section 8 hereof, and all screen analyses of aggregates, shall be made in accordance with the methods adopted or approved by the American Railway Engineering Association and in effect at the time such tests, analyses, etc., are carried out. In case the American Railway Engineering Association shall not have approved or adopted any methods for such tests, analyses, etc., the same shall be made in accordance with the methods then adopted or approved by the American Society for Testing Materials.

20. **Patents.** The manufacturer or contractor shall pay all royalties for the use of patented designs or devices or forms of construction and protect the railway company from all claims of infringements or liability for the use of such patents.

Discussion

Chairman Johnson abstracted the report and *moved the adoption of the conclusions.*

(Motion carried.)

A. V. Brown (Lake Shore Elec.): The highway crossing signs for the purpose of warning the public is not the

same which was adopted by the association several years ago.

Chairman Johnson: It is not the intention to differ from the sign shown in the Manual and adopted some years ago.

C. E. Lindsay (N. Y. C.): The committee says it would generally be better to adopt a uniform distance for all signs wherever possible rather than vary it for different classes of signs, the main consideration being safety for employees, which condition is controlled by distance from the track.

I agree with that. There are some signs which have been obscured by other signs not necessary for the engineman, and they should be placed a certain distance from the track, otherwise there may be some conflict.

Chairman Johnson: The third subject is "Highway grade crossings." The committee has not concluded its work on that subject. The next subject is "substitutes for wood crossing planks." That part of the report will be presented by Mr. Batchellor.

(F. D. Batchellor (B. & O.) abstracted the report and offered it as information.)

(T. E. Rust, chairman of the Subcommittee on Fence Posts, presented his report and it was received as information.)

(The committee was dismissed with thanks.)

Report of Committee on Electricity

Lack of sufficient time to study the Super Power Survey prevented the submission of an extensive report on it, although a summary is given. The survey deals with the sources of power available for railroad operation within economical reach of the Niagara and St. Lawrence rivers and tributaries. The National Electrical Safety Code standards are satisfactory and in accord with good practice. They are not intended as a designing specification but are primarily rules establishing minimum requirements. Working specification including lower factors of safety are not consistent with the code and the revision of the Manual is therefore recommended.

Edwin B. Katte
Chairman

Edwin B. Katte has been chairman for five years and a member of the committee for eleven years. As chief engineer of electric traction of the New York Central since 1906 he has been in intimate contact with the Grand Central terminal development of that road since its inception. He has thus had intimate contact with the development of steam railway electrification from the construction and more recently from the operating standpoint. This extended experience peculiarly qualifies him to direct the work of this committee in a field which is now receiving increasing attention from year to year as its possibilities become better understood.

1. THE COMMITTEE recommended that its report on Electrical Interference be accepted as information, published in the Proceedings and the subject continued.

1. The committee recommended that its report on Electrical Interference be accepted as information, published in the Proceedings and the subject continued.

2. The committee recommended that the report on Water Power (see Appendix B) be accepted as information, published in the Proceedings and the subject continued.

3. The committee recommended that its report on Electrolysis and Insulation be accepted as information and published in the Proceedings, that the subject be continued and the committee authorized to continue its representation on the American Committee on Electrolysis and that the report of the American Committee on Electrolysis be accepted, printed in the Manual and in the Bulletin for convenient reference.

4. The committee recommended that its report on the National Electrical Safety Code (see Appendix D) be accepted as information, published in the Proceedings and the committee authorized to continue its conferences with the U. S. Bureau of Standards.

5. The committee recommended that the progress report on Overhead Transmission Line Construction be accepted as information, published in the Proceedings and the subject continued.

6. The committee recommended that its Third Rail and Overhead Clearance Tables be accepted as information and published in the Proceedings.

7. The committee recommended that its report on collaborating with the committee on Economics of Railway Location be accepted as information and the cooperation continued.

8. The committee recommended that (a) the Railroad Specifications for Commercial Adhesive Tape for Electrical Purposes, and (b) the Railroad Specifications for Rubber Insulated Tape (see Appendix H) be approved and printed in the Manual as recommended practice.

9. In an addenda to its report, the committee submitted a revision of the association's "Railroad Specifications for Wire Crossings," with recommendation for their approval.

Committee: Edwin B. Katte (N. Y. C.), chairman; D. J. Brumley (I. C.), vice-chairman; H. M. Bassett (N. Y. C.), R. D. Coombs (Cons. Engr.), J. C. Davidson (N. & W.), G. Eisenhauer (Erie), F. D. Hall (B. & M.), G. W. Kittredge (N. Y. C.), W. L. Morse (N. Y. C.), M. Schreiber (P. S. R. of N. J.), W. M. Vandersluis (I. C.), S. Withington (N. Y. N. H. & H.), R. Beeuwkes (C. M. & St. P.), E. J. Correll (B. & O.), J. V. Duer, R. H. Ford (C. R. I. & P.), H. K. Lowry (C. R. I. & P.), A. E. Owen (C. of N. J.), E. B. Temple (Penna.), L. S. Wells (L. I.),

Appendix B—Water Power

The committee was instructed to continue the subject and report on the utilization of water power for railroad electric operation, coöperating, if desirable, with the United States Geological Survey in its Super Power Survey. The report of the Super Power Survey was not available until shortly prior to the conclusion of this report and the committee therefore was not afforded opportunity to give it the comprehensive study that the importance of the subject deserves. It studied the sources of electric power available for the operation of railroads, within economical reach of the Niagara and St. Law-

rence rivers and tributaries of the St. Lawrence river and presented the following conclusions:

SUMMARY

1. There are at present at Niagara Falls Hydro-Electric developments under United States control totaling 486,000 h. p., of which amount practically none is available for railroad electrification.

2. There are being developed at Niagara Falls under existing treaty revisions 660,000 additional h. p., of which 210,000 is on the American side. Of this latter amount 100,000 h. p. is available for railroad electrification and is sufficient for local requirements only.

3. There are possibilities, subject to Treaty revisions, of developments on the American side of 600,000 additional horsepower, of which the greater part may be available for railroad electrification. This would be sufficient to furnish power to a large portion of the steam railroads within economical transmission distance.

4. There are existing, or under development, other installations, such as the Canadian Chippewa-Queenstown project and that at Shawinigan falls. Power from these plants is not available for railroad electrification in the United States.

5. There are under contemplation other projects, such as the Niagara Falls Junior and the St. Lawrence Waterway. While such power would be available for railroad electrification, it is not believed that such projects have yet reached the stage where this committee can report as to their applicability.

6. The transmission of power developed at Niagara Falls is limited in distance only by ability to economically construct and safely insulate the transmission lines.

7. Power from Niagara Falls can be delivered to large consumers, within economical transmission distance, at approximately 1 cent per k. w. hr., which figure is sufficiently attractive as compared with present cost of steam production to warrant serious consideration as to its use for railroad electrification.

8. Hydro-electric power from Niagara Falls is constant because of the enormous storage reservoir afforded by the Great Lakes. None of the Niagara plants are augmented by steam electric stations common to many other hydro-electric installations.

Appendix D—Co-operation With the U. S. Bureau of Standards

The committee was directed to continue co-operating with the U. S. Bureau of Standards in the revision of the National Electrical Safety Code. The third revision of this Code is dated October 31, 1920, and was distributed in April of this year, printed in two volumes of the "Handbook Series" of the Bureau of Standards. The committee prepared a commentary on the national electrical safety code, with the object of acquainting the members of the association with the manner in which it can be used to advantage and wherein the Code requirements differ from accepted railroad practice.

CONCLUSIONS

1. The Code purports to establish a National Standard of Safety for the users of electrical apparatus. In general, the standard is satisfactory and in accordance with good practice.

2. The rules establish minimum requirements. Greater margins of safety are not prohibited. The committee does not therefore fail to support the Code when as in the case of Part 2 it suggests greater safety provisions.

3. It was not the intention of the Bureau of Standards that the Code should be regarded as a designing specification. It is therefore not inconsistent that the Code be supplemented by working specifications that specify factors of safety not less than those established by the Code.

RECOMMENDATIONS

The committee recommended that the Railroad Specifications for Electric Light, Power Supply and Trolley Lines Crossing, Steam and Electric Railways, adopted by the Association and printed in the Proceedings, Volume 21, 1920, page 208, be opened for revision with a view to make them conform with the Code as far as consistent with established railroad standards.

Appendix H—Standardization

The committee elected this year to report on friction and other tapes presented specifications which were the result of review of the A.S.T.M. specifications, somewhat modified but agreeable in such form, to the committee of the A.S.T.M. and to be by them in that form adopted. It was pointed out that the A.S.T.M. proposes these specifications as tentative, which is their practice with regard to all specifications for the first year after adoption. It is recommended that these specifications be adopted as recommended practice and printed in the Manual.

Discussion

(The report of the Committee on Electricity was presented by Chairman Katte.)

Chairman Katte: This year the Committee on Direction charged the Committee on Electricity with reporting on 9 subjects.

(The second subject, that of electrical interference, was presented by the chairman of that sub-committee, W. M. Vandersluis (I. C.). The report was received as information. W. L. Morse (N. Y. C.), chairman of the sub-committee on Water power, presented the report, which was received as information. The report on "Electrolysis" was presented by Chairman Katte.)

Chairman Katte: The sub-committee on electrolysis devoted its time during the past year to cooperation with the American Committee on Electrolysis. You will find this report of considerable value as a book of reference, as it contains the very last word on methods for mitigating electrolytic damage.

The committee moves that the report of the American Committee on Electrolysis be accepted as information, and published in the Manual as valuable permanent engineering data.

(Motion carried.)

Chairman Katte: The next item, "Co-operation with the U. S. Bureau of Standards," is shown in Appendix D. Since the committee formulated the conclusions there has been considerable activity in the matter of overhead crossings, and the committee has prepared an addenda to its report which is submitted as information. If this addenda is accepted it will form a part of the existing specifications.

I move that this addenda be approved and made part of the existing wire-crossing specifications.

(Motion carried.)

("Overhead Transmission Line Construction" was presented by S. Withington (N. Y. N. H. & H.), chairman of the sub-committee, and was received as information.)

(Chairman Katte reported on "Clearances—Rail and Overhead," in the absence of Mr. Bassett, while W. L. Morse reported on collaboration with Committee XVI—Economics of Railway Location, in the absence of Mr. Brumley. These reports were received as information.)

Chairman Katte: Appendix H—Standardization. This specification as written is precisely as the existing tentative specification of the A. S. T. M. and since the print-

ing a number of important changes and additions have been made and the committee therefore does not desire to recommend that the specification as printed in the Bulletin be adopted.

I move that these specificattions, instead of being submitted as recommended practice, be accepted as information.

(This portion of the report will be received as information.)

Chairman Katte: Since the committee's report was completed, the Board of Direction submitted another subject to the committee, viz.: "The Protection of Oil Sidings from Danger Due to Stray Currents."

The President: The report will be received as information.

Chairman Katte: I move that the report of the Committee on Electricity as modified by this meeting be accepted.

(Motion carried.)

G. J. Ray (D. L. & W.): As a matter of information I would like to get straight the motion which was passed at the beginning of the committee's report to place the entire report on electrolysis in the Manual. Is that the intent of that motion?

Chairman Katte: Yes, that was the intention. You will find that that report is really a valuable book of reference. Only a limited number were printed.

Mr. Ray: I think it should appear in the Annual Proceedings. We had a similar case yesterday and the matter was negatived on account of the length and character of the report. This would make a very large addition to the Manual.

Chairman Katte: The reason the committee recommends putting it in the Manual is that in effect it is a book of rule; it is a standard work, and we thought that the Manual was a handy place for it where it would not be forgotten.

H. L. Ripley (N. Y. N. H. & H.): We are loading our Manual to a point where it is no longer a hand book but has become a text book.

Chairman Katte: *I move that portion of the motion be reconsidered, and in lieu thereof that the report on electrolysis merely appear in the Manual by reference and cross-reference so that its location in the proceedings can be readily found.*

(The motion was carried and a motion that the report be referred to by cross-references in the Manual was carried. The committee was then dismissed.)

Engineering Association Holds Annual Dinner

Three Speakers Addressed Twenty-third Annual Banquet in Gold Room Last Evening

THE ANNUAL DINNER of the American Railway Engineering Association was held in the Gold room of the Congress hotel last evening with President L. A. Downs presiding. R. C. Marshall, Jr., general manager, Associated General Contractors of America, Washington, D. C., spoke on Some Needs of the Railroads. Judge James A. Mulligan, Ottawa, Ont., discussed The Basis of Patriotism, and Gus M. Dyer, professor of political economy, Vanderbilt University, Nashville, Tenn., talked on Government and Business. An interesting feature of the dinner was the presentation to President Downs of a badge by his fellow alumni of Purdue University. The presentation was made by A. A. Potter, dean of engineering of that institution, who spoke in part as follows:

"The Purdue members of the A. R. E. A. have requested me to present to you in their name a token of their esteem. They are greatly appreciative of your truly human qualities which have endeared you to your associates and to those who have been so fortunate as to have been employed under you. These alumni of Purdue University are pleased and proud of your accomplishments, of your unselfish devotion to your professions and of your active interest in your alma mater. It is with a deep sense of pleasure, Mr. President, that I now avail myself of the honor of presenting to you this certificate on behalf of the Purdue Alumni, together with their sincere wishes for your continued happiness and success."

Brief abstracts of the addresses follow:

General Marshall's Address

The United States has approximately 260,000 miles of railroads in operation or 2,600 miles per 1,000,000 inhabitants, whereas in 1910 we had 2,700 miles per million inhabitants. The amount constructed in the decade just passed is less than 50 per cent of that constructed 1880-1890 and less than that constructed in any decade since 1860. The decrease in railroad construction has occurred since 1913. To make up that deficiency as well as to keep pace with the normal increase in population will require building 6,000 miles of new track this year and every year for 10 years.

After the civil war this country gradually awoke to the fact that the construction of transportation facilities would open the avenue for national development, which in turn paid the debt of the war. It is a fact that more than 50 per cent of our vast country is even now unused and waiting to be developed. Much of this development depends upon reclamation and irrigation. But perhaps more important than any of these, our development requires an adequate transportation system, whether that be through roads, railroads, or canals.

A great deficit in railroad construction has piled up year by year since 1913. Railroad construction is not the only construction that has so piled up a deficit. This is also true of public utilities, public works, water developments, hydraulic developments, reclamation and irrigation, and housing. This creates an accumulated demand for construction such as exists in no other industry. The general contractor is only one element of the construction industry; but he is an element through whose hands a large percentage, if not all almost all, of the money passes that goes into that industry.

One of the great criticisms heard concerning construction companies is that they are not managed along the lines recognized and established in other industries, and that they are far behind in matters of estimating and cost accounting. An extensive study into these matters has shown that this condition will not be overcome until the basic agreements under which they work are brought into some semblance of harmony. Many revelations of conditions existing in the building and general construction industries during the past two years, show a need of better understanding between that industry and the others for which it works. It is only in recent years that building contracts have been drawn so that they contained any semblance of mutuality.

In the case of the railroads some years ago construction contracts as drawn by the legal department were about in keeping with the general policies of sovereignty pursued by the roads and had it not been for the fairness with which engineers administered these contracts it is questionable whether railroad development could have taken place. The American Railway Engineering Railway Association has done an excellent work in standardizing railroad contracts, but advices from various sections of the country indicate that in many cases the railroads have not grasped the value and scope of such an undertaking. Some action should be taken to show them that a very urgent need in future railroad development is a standard of contractual relation which will permit dealing along the lines recognized and approved by modern industry.

The fundamental principle that these contracts should express the rights of contractor and owner, so that the laws of proper economics might be carried out, has been working in the minds and consciences of those in the industry until at last it has found voice. This is recognized by the fact that in December a committee representing eight great national Associations got together to consider this subject. It seems to me perfectly clear that if this committee were to come to a unanimous conclusion, representing the composite individual opinions of those on the committee, after they have extensively discussed the several questions involved, that each of us should realize that we would be acting in the common good should we accept that conclusion without reservation.

It has been suggested that a universal construction agreement be adopted which will cover the obligations common to all work, leaving to several sets of general conditions those provisions which are peculiar to each individual type. In such manner we would be able to set up clearly the obligations of construction and to build up a strong foundation of precedents which would establish an ethical practice throughout. The principal idea behind the move for standardization is to coordinate these existing standards and adopt universal clauses wherever they can be used. Though the legal talent might not profit by such standardization the engineering department and individual engineers and architects undoubtedly would. This is one need of the railroad which concerns the engineering department directly and which the engineers will have to sponsor if it is carried out properly.

There is still another need of the railways which greatly concerns their future expansion, and in which the engineer will doubtless find an interest. This is the development of more executives with both engineering skill and a knowledge of business and transportation economies.

The difficulties attending future development of railways as private projects have greatly increased in complexity since the last generation. Railway executives are faced today with more puzzling difficulties than ever before. Labor troubles, legislation, government regulation and transportation economics greatly complicate the study to be made in pushing out new lines. There will doubtless be a closer liaison between engineering and the study of present and future markets. These new problems open an extensive field for combined engineering and economic studies. There is every reason to believe that the engineer can take up these studies of railroad building and solve their problems more readily than an executive with no engineering experience. This new field offers an opportunity for development of the highest type of executive ability, and with it will doubtless go a high degree of prestige and compensation.

Government and Business

In discussing this subject, Mr. Dyer said in part: "I have much sympathy for the railway officer today. Every man should be an optimist under present conditions. However, if a railway man is an optimist today, the Labor Board will hold him up, while if he is a pessimist, his bankers will hold him up. If he is an optimist he must be a pessimistic optimist, while if he is a pessimist, he must be an optimistic pessimist.

"Our industrial life is controlled by great natural laws. Is it not controlled by chance. When natural laws are violated, disease results. When laws of industrial life are violated, trouble and panic result. Much of our trouble today is because of the belief that wages result from bargaining between employer and employe. A second fallacy is that wages and profits come out of the same fund and that wealth comes from the exploitation of labor.

"The present wage levels of railroad employes are now on an artificial level far above their natural rates. Because of the specialization which has come in industry we need some common standard as a basis for all wages.

"Our chief troubles today are a result of the mistakes of government in its relations to business. It is the function of government to see that fair play exists between groups. But we are departing from this theory. Under the Labor Board government is entering as a co-director of business. Any kind of a co-directorship is antagonistic to efficiency. Furthermore, when the government has no definite policy business cannot anticipate its actions and this uncertainty is deadly. The Adamson law and the legislation creating the Labor Board are ransoms paid to organized minorities.

"The time has come when intelligent leadership in business shall stand together and demand that the government withdraw from the sphere of production, that it shall curb any organization which tries to interfere with productive efficiency and that it shall define some theory of relation with industry and stand by it against minorities."

James A. Mulligan

The Canadian speaker was James A. Mulligan, of Ottawa, Ont, who opened his address by a tribute to the engineering profession. In his opinion its services to society are not appreciated in full measure. His real theme was the Government of Canada, its differenciation from that of the United States and the possibilities of any change from its present form. Mr. Mulligan punctuated his remarks with many a pointed story, and his address was enjoyed thoroughly by those present.

In the Snowshed

The A. R. E. A. Elects New Officers

Results of Annual Election Announced Yesterday; Sketch of President-Elect J. L. Campbell

AT THE CLOSE OF THE SESSION yesterday afternoon President Downs announced the results of the election of officers for the ensuing year. The names of those elected are as follows:

President—J. L. Campbell, chief engineer, El Paso & Southwestern, El Paso, Tex.

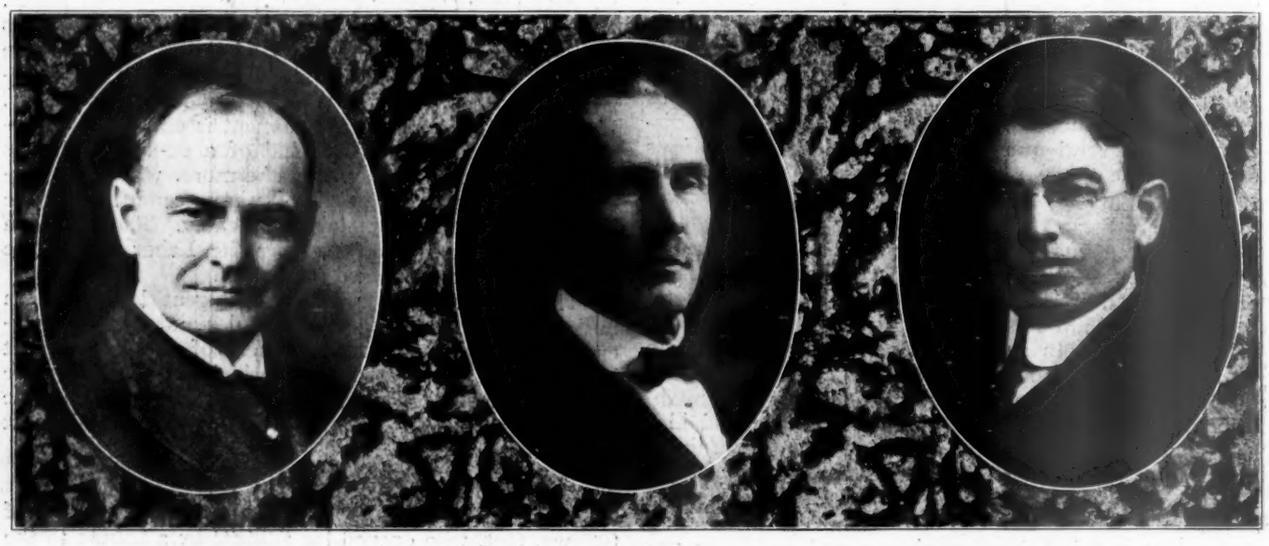
Vice-President—G. J. Ray, chief engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Treasurer—George H. Bremner, consulting engineer, Chicago.

Secretary—E. H. Fritch, Chicago.

Directors—D. J. Brumley, chief engineer, Chicago Terminal Improvements, Illinois Central, Chicago; Maurice Coburn, engineer maintenance of way, Pennsylvania System, Indianapolis, Ind.; H. T. Douglas, Jr., chief engineer, Chicago & Alton, Chicago.

Nominating Committee—A. M. Burt, assistant to vice-president operation, Northern Pacific, St. Paul, Minn.; J. V. Hanna, chief engineer, Kansas City Terminal, Kansas City, Mo.; P. B. Motley, engineer bridges, Canadian Pacific, Montreal, Que.; W. J. Backes, engineer maintenance of way, New York, New Haven & Hartford, New Haven, Conn.; A. O. Ridgway, assistant chief engineer, Denver & Rio Grande Western, Denver, Colo.



E. H. Lee
First Vice-President

J. L. Campbell
President

G. J. Ray
Second Vice-President

John Logan Campbell, President of the American Railway Engineering Association

J. L. Campbell, the twentieth president of the American Railway Engineering Association, needs no introduction to those of its members who have attended the conventions, for few men have taken a more consistent and regular part in the discussions. By the same token, few of the members who participate in the work of the conventions have evinced a more painstaking study of the reports in advance of the meetings. Nor is this thoroughness his only attribute. His consistent attendance at session after session portrays a broad scope of interest which has been equalled in few men. Perhaps the fact that, like other men coming from the more remote portions of the country who are denied the opportunities of intimate contact with men in the same line of work, he has felt that the annual conventions afford him an opportunity which he desired to utilize to the utmost. In spite of the obstacle of remote residence, Mr. Campbell has set an excellent example in his wholehearted interest in committee work, which has repeatedly won him the offer of chairmanships but which he has as consistently declined because he felt that others more conveniently located could conduct the work of committees with greater effectiveness.

In Mr. Campbell's presidency the great west is for the first time truly represented, for he is truly of the west. Going from his home in Illinois to El Paso as a young man in 1888, he participated in the pioneer development of a new country and as the sober, law abiding element was gradually organized to establish law and order, John Logan Campbell, the engineer and railway officer, identified himself as a citizen who saw responsibilities outside the scope of his regular employment.

There is a departure from the conventional in Mr. Campbell's career as a railway man. Normally the young man in railway service is transplanted from his home surroundings to distant places by reason of his employment by the railroad. But we find that young Campbell went into western Texas to take up land and mining engineering and was established as a resident of western Texas for some years before he entered railway employment. In fact, he served for four years as city engineer of El Paso, Tex., before becoming a resident engineer on the construction of the Rio Grande Northern in 1894, his first railway connection. Developing proficiency in railway location and construction, his employment carried him over a considerable area of the west for a period of nearly ten years. But the fates decided that he was to be returned to the scene of his first engineering experiences and for the last 17 years he has been responsible

for maintenance of way, location and construction on the El Paso & Southwestern System—from 1905 to 1920 with the title of engineer maintenance of way and since 1920 as chief engineer. Fortune was also kind to him in that she placed his destinies with a railway property of more than average financial stability. Virtually his position has been that of development engineer for the Phelps-Dodge mining interests and he has in consequence been afforded opportunities for the exercise of engineering ability along broader lines than those permitted the engineering officers of less favored properties. His connection for a number of years with the Water Service Committee of the association may properly be explained by his own interest in water service problems, as these have comprised one of his major responsibilities on the El Paso & Southwestern.

The White Mountain water supply system, with a capacity of 7,000,000 gal. daily and a pipe line 141 miles long, which is probably the most comprehensive water service project ever carried out by any railroad, was developed under his direction and embodies many features that bear the stamp of the master engineer.

N. R. A. A. Past Presidents Group

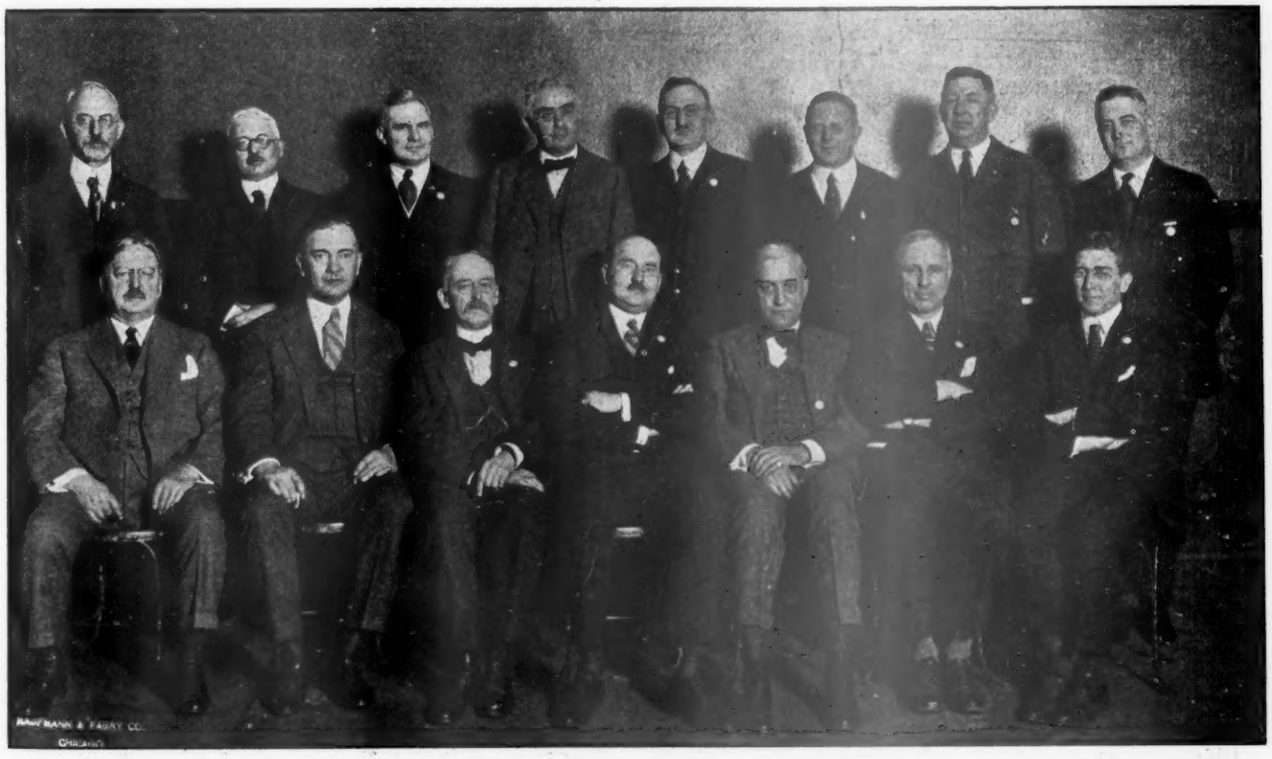
FOR THE FIRST TIME in the history of the National Railway Appliances Association all of the past presidents were present at the exhibit Wednesday afternoon. These men, with the exception of N. Hench, and with C. W. Kelly, secretary and treasurer of the association, were assembled at 3:30 for a group photograph. These men each served a year as president of the association and are named in order as here given, starting with 1909.

G. Stanton, Cleveland Railway Supply Co.
W. F. Schleiter, Dilworth, Porter Co.
T. W. Snow, T. W. Snow Construction Co.
R. E. Belknap, American Chain Co.
A. P. Van Schaick, Bethlehem Steel Co.
T. R. Wyles, Detroit Graphite Co.
N. Hench, Carnegie Steel Co.
P. W. Moore, P. & M. Co.
H. M. Sperry, Signal Companies.
E. H. Bell, Railroad Supply Co.
M. J. Trees, Chicago Bridge & Iron Works.
P. C. Jacobs, Johns-Manville Inc.
J. B. Strong, Ramapo Iron Works.
G. C. Isbester, American Chain Co.
T. W. Aishton, National Malleable Casting Co.
C. W. Kelly, secretary and treasurer, Kelly-Derby Co.

A. R. E. A. Registration

THE REGISTRATION of members of the American Railway Engineering Association yesterday aggregated 146 and of guests 48, making a total registration for the day of 193. Including the registration of 666 Tuesday, the total registration for the two days reaches 859, as compared with 718 for the same period last year. Of this latter total 687 were members.

Abbott, W. P., asst. div. engr., B. & O., Cincinnati, Ohio.
Anderson, Arthur, instrumentman, N. Y. C., Chicago.
Armstrong, H. J., asso. prof. c. e., Armour Institute, Chicago.
Bainbridge, C. N., engr. of des., C. M. & St. P., Chicago.
Baldwin, Hadley, asst. ch. engr., C. C. C. & St. L., Cincinnati, Ohio.
Ballard, E. E., office engr., M. K. & T., St. Louis, Mo.



Top Row, Left to Right—H. M. Sperry, E. H. Bell, M. J. Trees, C. W. Kelly, P. C. Jacobs, J. B. Strong, G. C. Isbester and T. W. Aishton.

Bottom Row, Left to Right—G. Stanton, W. F. Schleiter, T. W. Snow, R. E. Belknap, A. P. Van Schaick, T. R. Wyles and P. W. Moore.

Barnhart, E. H., asst. engr., B. & O., Baltimore, Md.
Barry, G. R., div. engr., Penna., Logansport, Ind.
Beach, D. P., div. engr., Penna., Indianapolis, Ind.
Bennett, W. R., asst. engr., Wabash, St. Louis, Mo.
Bertram, H. A., div. engr., C. & O. Ry. of Ind., Peru, Ind.

Botts, A. E., div. engr., C. & O., Huntington, W. Va.
Bowser, E. H., supt. timber dept., I. C., Memphis, Tenn.
Bragg, R. R., div. engr., C. R. I. & P., Dalhart, Texas.
Briggs, Z. M., asst. engr., Penna., Pittsburgh, Pa.
Brooke, G. D., supt. trans., B. & O., Cincinnati, Ohio.
Brown, W. E., div. engr., C. R. I. & P., Fairbury, Neb.
Buehler, Walter, engr. wood pres., New York.
Burt, J. W., engr. m. of w., C. C. C. & St. L., Indianapolis, Ind.
Butler, E. S., asst. val. engr., M. K. & T., Parsons, Kan.
Carpenter, H. R., asst. ch. engr. c., Mo. Pac., St. Louis, Mo.
Chipman, Paul, val. engr., P. M., Detroit, Mich.
Clark, H. G., asst. to pres., C. R. I. & P., Chicago.
Clement, S. B., ch. engr., T. & N. O., North Bay, Ont.
Condron, T. L., cons. engr., Chicago.
Congdon, C. O., dis. engr., Mo. Pac., Kansas City, Mo.
Cook, R. A., val. engr., C. & A., Chicago.
Copeland, R. D., asst. engr., Wabash, Moberly, Mo.
Correll, E. J., div. engr., B. & O., New Castle, Pa.
Cowherd, Geo. R., sig. eng., E. P. & S. W., El Paso, Tex.
Cowper, J. W., pres., J. W. Cowper Co., Buffalo, N. Y.
Cox, J. B., con. engr., Chicago.
Crable, Arthur, engr. m. of w., H. V., Columbus, Ohio.
Crowe, S. N., supr., Wabash, Montpelier, Ohio.
Crugar, E. L., dist. engr., I. C., New Orleans, La.
Danes, J. E., div. engr., Wabash, Decatur, Ill.
Darrow, F. T., asst, ch. engr., C. B. & Q., Lincoln, Neb.
Davidson J. C., engr. elec. trac., N. & W., Bluefield, W. Va.
Davis, Garrett, div. engr., C. R. I. & P., Cedar Rapids, Iowa.
De Geer, B. W., engr. water serv., G. N., St. Paul, Minn.
Deslauriers, L. W., asst. engr., Can. Pac., Montreal, Canada.
Dewees, A. R., div. engr., P. M., Saginaw, Mich.
Dick, H. B., asst. val. engr., B. & O., Baltimore, Md.
Duer, J. V. B., elec. engr., Penna., Altoona, Pa.
Duffy, C. M., asst. sig. engr., C. R. I. & P., Des Moines, Iowa.
Eby, C. W., asst. engr., W. C. F. & N., Waterloo, Iowa.
Emmons, S. E., asst. engr., A. A., Owosso, Mich.
Engle, C. W., engr. m. of w., C. C. C. & St. L., Wabash, Ind.
Etter, W. K., Sr., asst. to vice-pres. in chg. of op., A. T. & S. F., Chicago.
Fair, J. M., supr., Penna., Philadelphia, Pa.
Fairbairn, J. M. R., ch. engr., Can. Pac., Montreal, Canada.
Fowler, W. E., ch. engr., Montour, Coraopolis, Pa.
Freygang, A. H., div. engr., B. & O., Grafton, W. Va.
Garner, R. D., engr. const., S. N. E., Providence, R. I.
Gault, J. J., asst. engr., C. M. & St. P., Chicago.
Giles, W. H., asst. engr., Mo. Pac., St. Louis, Mo.
Gilkey, R. H., supr. b. & b., Cent. of Ga., Savannah, Ga.
Gowdy, R. C., ch. engr., C. & S., Denver, Colo.
Griswold, H. C., Louisville, Ky.
Hales, F. S., asst. engr., N. Y. C. & St. L., Cleveland, Ohio.
Hallsted, R. H., div. engr., M. P., Wynne, Ark.
Hanna, John V., ch. engr., K. C. Term., Kansas City, Mo.
Hansen, H. J., office engr., C. M. & St. P., Chicago.
Harting, O. F., asst. ch. engr., St. L. Term., St. Louis, Mo.
Hayes, W. P., div. engr., Mo. Pac., Monroe, La.
Heggie, W. G., office engr., G. T., Detroit, Mich.
Heritage, C. S., bridge engr., K. C. Sou., Kansas City, Mo.
Herth, C. E., B. & O., Chillicothe, Ohio.
Holm, R. H., div. engr., Mo. Pac., Chester, Ill.
Howard, R. H., ch. engr. m. of w., Wabash, St. Louis, Mo.
Irwin, J. C., val. engr., B. & A., Boston, Mass.
Jacoby, H. S., The H. K. Ferguson Co., Cleveland, Ohio.
Jenkins, J. B., val. engr., B. & O., Baltimore, Md.
Johnson, Noah, val. engr., Wabash, St. Louis, Mo.
Johnston, D. B., div. engr., Penna., Louisville, Ky.
Jones, F. A., div. engr., Mo. Pac., Falls City, Neb.
Jones, Paul, supt., Penna., Fort Wayne, Ind.
Judd, F. R., engr. of bldgs., I. C., Chicago.
Jump, S. C., asst. engr., I. C., Dubuque, Iowa.
Katte, Edwin B., ch. engr., elect. tract., N. Y. C., New York.
Kegler, W. C., engr. m. of w., C. C. C. & St. L., Galion, Ohio.
Kennedy, R. E., pilot engr., B. & O., Baltimore, Md.
Kimball, L. P., engr. of bldgs., B. & O., Baltimore, Md.
Lahmer, J. A., prin. asst. engr., Mo. Pac., St. Louis, Mo.
Larsen, Albert, div. engr., Miami Conservancy District, Dayton, Ohio.
Livingston, H. T., div. engr., C. R. I. & P., Manly, Iowa.
Lockwood, R. J., asst. mgr., United of St. Louis, St. Louis, Mo.
Longshore, R. L., supr. of track, Wabash, Montpelier, Ohio.
Longwill, M. F., div. engr., Wabash, Montpelier, Ohio.
Macomb, J. deN., office engr., A. T. & S. F., Chicago.
McFetridge, W. S., prin. assist. engr., B. & L. E., Greenville, Pa.
McKey, D. M., loc. engr., S. A. L., Plant City, Fla.
Merwin, C. E., ch. engr., Det. Term., Detroit, Mich.
Miller, L. C., asst. ch. engr., M. & St. L., Minneapolis, Minn.
Morse, W. L., spec. asst. engr., N. Y. C., New York.
Mullen, Joseph, gen. mgr., Southern Acid & Sulphur Co., St. Louis, Mo.
Murray, W. A., engr. of track, N. Y. C., New York.
Nagel, John R., div. engr., Mo. Pac., Wichita, Kan.
Neiler, S. G., con. engr., Neiler Rich & Co., Chicago.
Ogle, W. F., sales mgr., W. S. Track Sales Co., Chicago.
Passmore, E. W., div. engr., C. B. & Q., Alliance, Neb.
Perkins, C. D., div. engr., N. Y. N. H. & H., Stanford, Conn.
Petticrew, C. B., div. engr., St. L. S., Illmo, Mo.
Podmore, J. M., div. engr., N. Y. C., Toledo, Ohio.
Post, W. M., supt. tel. & sigs., Penna., Pittsburgh, Pa.
Puder, F. R., asst. reg. engr., U. S. Railroad Administration, Chicago.
Ramsey, F. R., ch. engr., T. St. L. & W., Frankfort, Ind.
Richardson, C. P., engr. track elev., C. R. I. & P., Chicago.
Riggs, H. E., prof. of c. e., University of Michigan, Ann Arbor, Mich.
Ringer, Frank, ch. engr., M. K. & T., St. Louis, Mo.
Rist, C. J., div. engr., P. M., Saginaw, Mich.
Roach, J. H., val. engr., N. Y. C., New York.
Robertson, T. H., asst. engr., I. C., West Frankfort, Ill.
Rogan, J. E., rdmstr., I. C., New Orleans, La.
Rohbock, W. L., ch. engr., W. & L. E., Cleveland, Ohio.
Roller, W. L., assist. engr., H. V., Columbus, Ohio.
Rose, L. S., assist. to gen. mgr., C. C. C. & St. L., Cincinnati, Ohio.
Schmid, R. L., div. engr., N. C. & St. L., Atlanta, Ga.
Schmidt, Edward C., prof. of ry. eng., University of Illinois, Urbana, Ill.
Sedwick, T. D., engr. of tests, C. R. I. & P., Chicago.
Senter, S. S., ch. engr., A. C. & Y., Akron, Ohio.
Sessions, O. H., gen. rdmstr., D. & T. S., Monroe, Mich.
Shaw, H. J., div. engr., Penna. Cambridge, Ohio.
Shouse, G. B., first asst. on engr. corps, B. & O., Flora, Ill.
Sillcox, L. K., gen. supt. mot. power, C. M. & St. P., Chicago.
Smith, A. C., vice-pres., Morden Frog & Crossing Works, Chicago.
Smith, C. E., cons. engr., St. Louis, Mo.
Smith, D. W., val. engr., H. V., Columbus, Ohio.
Snyder, J. A., rdmstr., M. C., Jackson, Mich.
Sperry, H. M., New York.
Steel, D. A., asso. editor, Railway Age, Chicago.
Stevens, J. W., div. engr., N. Y. C., New York.
Strong, J. B., vice-pres., Ramapo Iron Works, Hillburn, N. Y.
Thompson, F. W., div. engr., C. R. I. & P., Des Moines, Iowa.
Tuthill, G. C., bridge engr., M. C., Detroit, Mich.
Van Antwerp, E. I., real est. insp., G. T., Detroit, Mich.
Vent, F. G., asst. engr., I. C., Chicago.
Wait, B. A., instrumentman, C. R. I. & P., Des Moines, Iowa.
Walsh, G. R., assist. engr., Mo. Pac., St. Louis, Mo.
Warden, R. E., assist. engr., Mo. Pac., Little Rock, Ark.
Waterman, J. H., supt. timber pres., C. B. & Q., Galesburg, Ill.
Wilbur, O. G., pilot engr., B. & O., Baltimore, Md.
Williams, C. C., prof. c. e., University of Kansas, Lawrence, Kan.
Williams, H. W., spec, repr. to supt. of motive power, C. M. & St. P., Chicago.
Wilson, C. A., cons. engr., Cincinnati, Ohio.
Woodbury, W. H., val. engr., D. & I. R. and D. M. & N., Duluth, Minn.
Wyant, Leroy, prin. assist. sig. engr., C. R. I. & P., Chicago.

Guests

Bolin, W. C., pilot engr., B. & O., Baltimore, Md.
Cornell, A. M., ch. engr., P. & M. Co., Chicago.
Dennis, Olive W. (Miss), draftsman, B. & O., Baltimore, Md.
Derrig, J. T., dist. engr., N. P., St. Paul, Minn.
Disbrow, C. A., Rail Joint Co., New York.
Dowdall, Universal Portland Cement Co., Chicago.
Eckles, H. E., I. C., Chicago.
Gaffney, T. H., rdmster., Montour, Coraopolis, Pa.
Gilbert, W. T., cons. engr., Headley Good Roads Co.
Grover, C. H., C. R. I. & P., Manly, Ia.
Hartley, J. G., asst. div. engr., Penna., Pittsburgh, Pa.
Hawkins, C. L., engr., of w. and str., United Ry. Co. of St. Louis, St. Louis, Mo.
Hayes, J., civil engr., Gary, Ind.
Hicks, P. R., American Wood Preservers Asso., Chicago.
Huffman, C. B., asst. engr., M. P., Falls City, Neb.
Hughes, R. P., asst. to r. of w. agt., A. T. & S. F., Topeka, Kan.
Hunter, H. L., div. engr., A. T. & S. F., Chillicothe, Ill.
Irwin, W. B., of. engr., G. N., St. Paul, Minn.
Jerkinson, C., insp., Rail Joint Co., New York.
Jones, D. J., mech. asst., I. C., Chicago.
Keamerf, R. P., rdmster, L. & N., Scranton, Pa.
Kelley, J. B., asst. gen. rdmster, M. St. P. & S. S. M., Minneapolis, Minn
Kelly, J. B., insp. m., M. & St. L., Minneapolis, Minn.
Kirkley, T. M., mech. asst. to gen. supt. mot. pr., C. M. & St. P., Chicago.
Lichtenwalner, G., instrumentman, G. T. W., Battle Creek, Mich.

Lind, F., rdmster, C. P., Golden, B. C.
Longstreet, P. E., res. mgr., Massey Concrete Products Corp., Chicago.
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Reinert, W. A., asst. prof. c. e., Armour Institute, Chicago.
Robinson, C. R., vice-pres., Inland Steel Co., Chicago.
Robinson, Lee, shop engr., I. C., Chicago.
Scratzman, R. F., asst. engr., C. M. & St. P., Chicago.
Smith, R. C., prin. asst. engr., M. & St. L., Minneapolis, Minn.
Strong, C. H., engr., Georgia Railway & Power Co., Atlanta, Ga.
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Tranzon, F. C., supr. b. and b., G. T., Durand, Mich.
Wales, D. C., asst. engr., G. T., Durand, Mich.
Warren, T. P., of. engr., C. R. I. & P., Des Moines, Ia.
Watson, W. J., cons. engr., Cleveland, Ohio.
Weymouth, H., Bethlehem Steel Co., Baltimore, Md.
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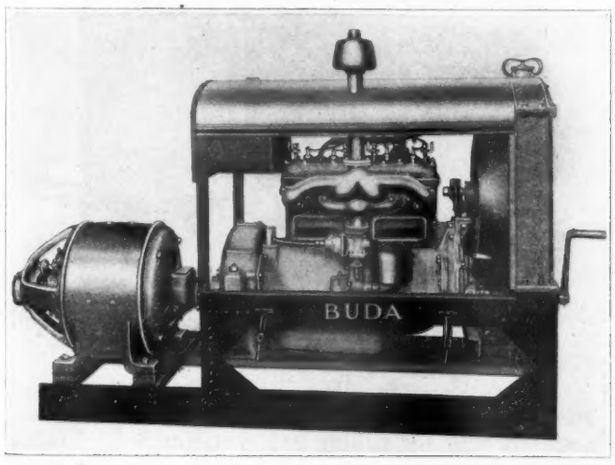
Wilkinson, J. F., engr., G. T., Detroit, Mich.

A General Utility Power Plant

AMONG A NUMBER of recent developments in equipment and machinery of interest to railways is a four-cylinder gasoline-operated power unit now being manufactured by the Buda Company, Chicago. The machine is essentially an automobile engine, which has been modified only enough to permit of general use. Originally designed and perfected for the propelling of heavy duty motor trucks and still manufactured on a large scale for this purpose, the power unit presents a particularly interesting object of study on the part of railway



The Buda Unit Power Plant Connected to an Electric Generator

engineers by reason of such features as the workmanship it embodies, the efficiency of its operation and performance, its adaptability for many kinds of service for which an automobile type of engine is particularly suited, and for the relatively low cost permitted by the large scale upon which the engines are manufactured.

As shown by the illustration, the plan consists simply of accommodating the engine to a steel platform and hood by reason of which it may be transported from place to place for use in a variety of operations or bolted to a permanent foundation. The machine weighs about 1,000 lb., and is manufactured in five sizes, unit 20 running at 1,000 to 1,450 r. p. m., and developing 20 to 26½ brake horsepower; unit 25 running at 900 to 1,400 r. p. m., and developing 20 to 28 brake hp.; unit 30, running at 800 to 1,250 r. p. m. and developing 24 to 35 brake hp.; unit 40, running at 800 to 1,000 r. p. m. and developing 31 to 40 brake hp., and unit 50, running at 700 to 1,000 r. p. m. and developing 30 to 51 brake hp.

While particularly adapted for the generating of electric current for use in lighting, storage battery charging, arc-welding outfits, or electric operation of machines, the plant is also adapted to drive triplex and other types of pumps, various kinds of hoists, concrete mixers, air compressors and other kinds of machinery. When connected to an electric generator the plant will furnish power according to the following table:

	Direct Current		Alternating Current	
Unit No.	R. P. M.	K. W.	R. P. M.	K. W.
20	1450	16.5	1200	14
30	1200	20	1200	20
40	1000	25	900	22.5
50	925	30	900	30

The engine is furnished with or without the generator, together with radiator, complete head and side covers, water pumps, fan and belt, carburetor, air cleaner, magneto with coupling, muffler, flexible power transmission coupling, starting crank, gasoline tank and speed-regulating governor, and, where required, is also furnished with a friction clutch or with a driving pulley for attaching to the drive shaft. Before leaving the factory each engine is subjected to a series of tests covering three periods; the first covers the running-in process and the second the power test. After this the engine is completely dismantled, inspected and re-assembled for the final test which is made to ascertain what electric power it is capable of delivering.

Obviously the character of the device gives it a wide scope of use in railway service such as that of furnishing lighting at outlying depots or shops, of furnishing power to operate machinery in shops or of pumps in water stations and for use in track maintenance in supplying electricity for arc-welding sets or in driving air compressors. The machine runs 10 hours on 1 gal. of gasoline.

Automatic Protector for Controllers

EVERY USER OF electric controllers has experienced more or less trouble from arcing and burning of the contacts, especially where there are unskilled attendants or where frequent electrical inspection is not the rule. The burning takes place when the contact is made or broken, especially where heavy current is handled or high voltage is used.

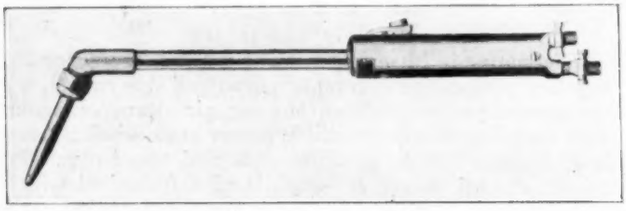
An automatic device has recently been developed that completely eliminates this objectionable burning and the consequent replacement of fingers and contacts by making and breaking the circuit entirely outside the controller. By positive mechanical means the first motion of the controller handle actuates a switch in the closing coil circuit of a magnetic switch or circuit breaker which closes the circuit just after the first contact is made by the controller fingers. The circuit is held closed as long as it is desired to operate the motor. The least motion of the controller handle toward the off position opens the auxiliary switch, thereby opening the motor circuit through the circuit breaker with no possible burning of the controller contacts. The handle has to be returned to the off position before the switch can be closed again.

In short, with this protector, which is made by Geo. P. Nichols & Bro., Chicago, the controller performs all its usual functions, except the actual making and breaking of the circuit, and burning of the contacts is made impossible. Furthermore, its use makes it possible to em

ploy the ordinary types of controller where otherwise contactor panels with master switches would have to be used.

A New Acetylene Torch for Welding and Cutting Operations

IN THE LAST FEW YEARS there has been an extensive development in the use of the gas flame and electric arc in railway service and the interest taken in them by railway engineering officers has increased accordingly by reason of the possibilities afforded of effecting economies or facilitating work in the field as well as in the shop. As might be expected from the fact of its receiving such attention, extensive developments have also been made in the equipment used for the purpose.



The Milburn Cut-Weld Torch

One development of a recent date along this line is a combination cutting and welding torch now being manufactured by the Alexander Milburn Company, Baltimore.

The torch is known as the cut-weld torch. Having been designed to meet the need of apparatus equally adapted to both welding and cutting operations, it is of particular interest to railway officers by reason of the diversified nature of the service ordinarily required of any one outfit. With this torch it is possible to cut 19-in.

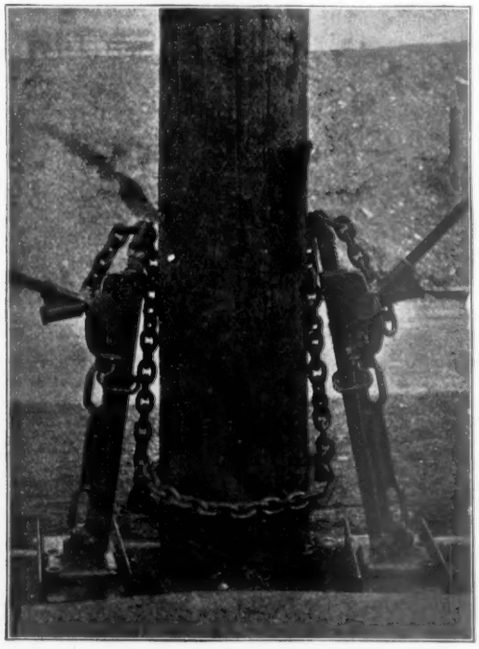
Cutting a 19-in. Billlet in One Operation

steel and by merely changing the tip to weld any thickness lending itself to welding. As the hose connections are not disturbed, no gas is wasted. The accompanying illustration shows the torch in the process of cutting 19-in. steel with one cut, for which purpose a four bottle oxygen manifold is used, furnishing oxygen at 190 lb. and acetylene at 15 lb. pressure. As a further illustration of the utility of the torch the manufacturers call attention to a test recently made in an eastern railway shop in which 341 5/8-in. rivets were cut per hour, a performance which is said to have established a new speed record for the entire system.

In railway service, in addition to rivet cutting, the torch has also shown decided economies thus far in such work as the cutting of locomotive fire box sheets, steel ties and frames, and in the wrecking of bridges and steel structures, as well as in reclamation yards and in the cutting of steel cars. The torch is claimed to be economical in its consumption of gas, both in cutting and in welding work. When welding 1.2-in. metal with a gage pressure of acetylene at 6 1/8 lb. and the oxygen at 9 lb., the torch consumes 72 cu. ft. per hour of each gas.

A Jack for Extracting and Lowering Poles

IT IS NOT UNCOMMON in railway service to encounter jobs involving the withdrawing of poles from the ground or their lowering into position. In such cases it is often the practice to perform the work with whatever equipment is at hand. In view of this fact, it is



Two Joyce Pole Jacks in Position for Extracting a Loaded Pole

of interest to note a recent development for this purpose.

The Joyce Pole Jack No. 88, as this device is known, is designed both for pulling and replacing loaded poles. As shown in the illustration, it is built upon a pivoted base and has an unusually long rack which carries a dog at the top to hold the chain. This jack is 38 in. high, has a lift of 27 in., weighs 150 lb. complete with chain and lever, and has a lifting capacity of 15 tons. The mechanism consist of two coils and a large spring, and the construction is such as to afford security against breakage at any point, particularly in the base, which is usually the weakest point of such devices.

The jack is operated by means of a lever as any ordinary jack and is secured against the possibility of dropping the load, the operation of lowering the pole requiring the operator only to reverse the control lever at the side of the jack whereupon the load is lowered automatically one notch at a time, in the same manner as it was raised. The double lever socket shown in the illustration is provided to permit of its easy operation when

the jack is pivoted on its base against the pole. Where it is simply required to extract the pole, one jack is sufficient, the reason for using the two jacks shown in the illustration arising from the fact that the pole was a loaded one which it was intended to hold in place while the butt end was sawed off. This device is manufactured by the Joyce-Cridland Company, Dayton, Ohio.

A Coaling and Sanding Plant With Ground Storage Facilities

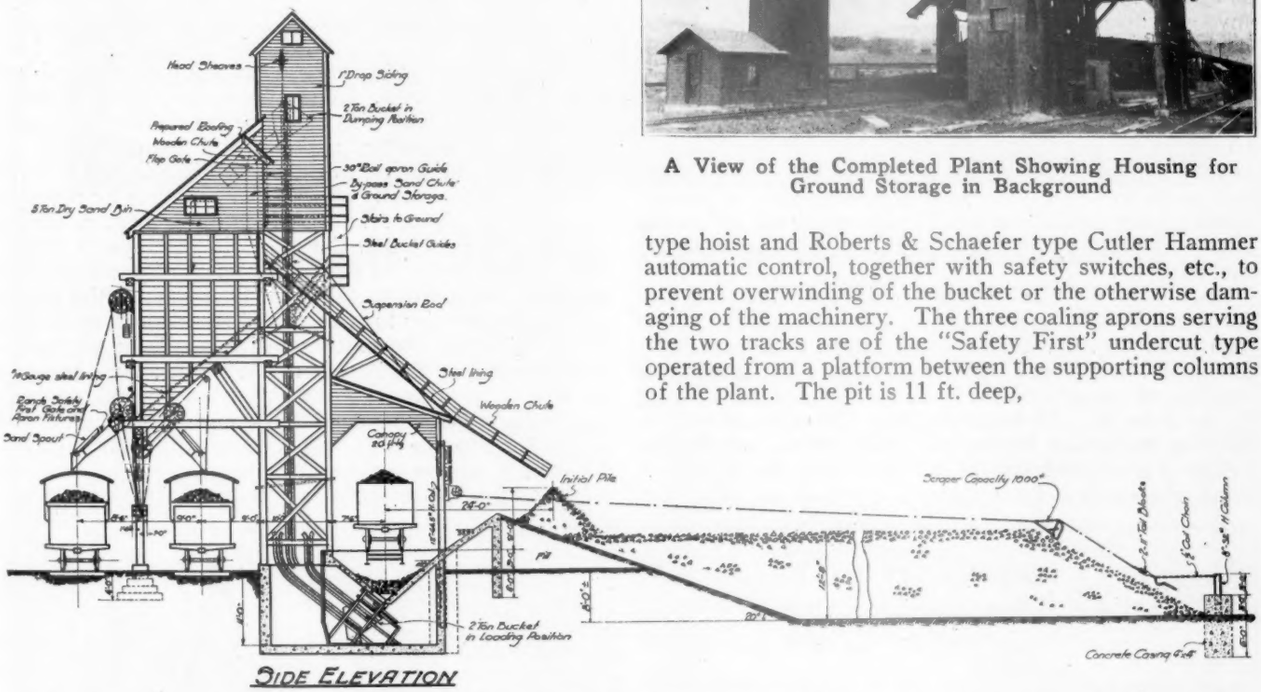
THE CENTRAL VERMONT has recently replaced its coaling plant at St. Albans, Vt., with facilities which present a distinctly novel treatment of the coal and sanding problem. The installation is a creation of the Roberts & Schaefer Company, Chicago, and consists essentially of a 300-ton capacity Roberts & Schaefer counterbalanced bucket, shallow pit type coaling station of frame construction and a 50-ton "RandS" gravity sand plant, together with ground storage facilities for 20,000 tons of coal.

The novel features of this installation will be apparent from an examination of the illustrations and from the following description of its operation: The coal is first dumped into a receiving hopper 20 ft. in length, from which it is fed through an undercut gate into a 2-ton capacity elevating bucket, which is then hoisted in the usual manner to the point of dumping. Unlike the usual design, however, the coal in this case may either be dumped directly into the coal bin or into a by-pass chute, as shown in the drawing, the latter serving to divert the coal into a storage pit situated on the ground at one side of the plant, all coal intended for storage thenceforth being distributed by means of a 1,000-lb. capacity drag scraper over the storage area, where it may be piled to a depth of 13 ft. When it is desired to use this storage coal the operation then consists simply of dragging the coal by means of the drag scraper into the initial storage pit and over the hump into the coal hopper, from which it is elevated into the bin by the elevating buckets the same as coal from cars.

In the case of the sand plant, the wet sand is elevated in the same bucket used for coal and is spouted into a 50-ton capacity storage bin, from which it is fed by gravity into a Beamer Patent steam sand dryer. When dry the sand is then elevated by air pressure to an overhead storage bin of 5 tons capacity, from which it is fed by gravity to the engine as required.

The coaling plant has an elevating capacity of 75 tons per hour. The elevating bucket is self-opening and self-closing and all elevating machinery is automatic in its operation, the latter equipment consisting of a 22-hp. General Electric reversible motor with cast iron base drum type hoist and Roberts & Schaefer type Cutler Hammer automatic control, together with safety switches, etc., to prevent overwinding of the bucket or the otherwise damaging of the machinery. The three coaling aprons serving the two tracks are of the "Safety First" undercut type operated from a platform between the supporting columns of the plant. The pit is 11 ft. deep,

A View of the Completed Plant Showing Housing for Ground Storage in Background



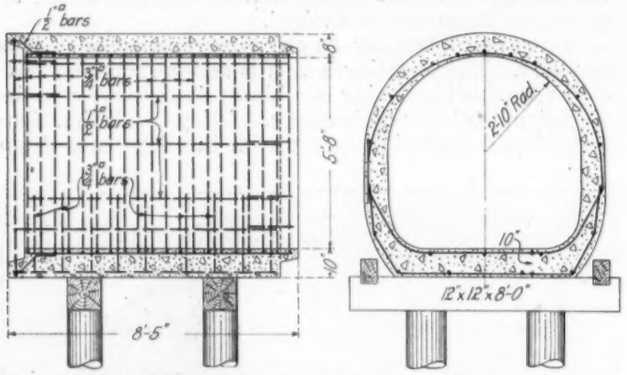
SIDE ELEVATION

Diagramatic View of Central of Vermont Coaling and Sanding Plant at St. Albans, Vt., Showing Ground Storage Arrangement

The storage machinery consists of a double drum hoist and belt drive motor, located in a separate building at the side of the coaling plant, together with a system of I-beam posts distributed around the storage area to guide the drag scraper. The capacity of the machinery is about 100 tons per hour. The ground storage equipment was furnished by the R. H. Beaumont Company, Philadelphia.

Something Different In Pre-Cast Concrete Pipe

THE "SOMETHING DIFFERENT in pre-cast concrete pipe" alluded to in the title has reference to the design of sewer pipe recently adopted by the Lehigh Valley in connection with the filling in of a considerable area around the Jersey shore of the New York harbor incident to the development of the new Claremont freight terminal. In connection with this improvement it was necessary to extend two Jersey City sewers a distance of about 2,000 ft. As the area to be filled in was covered with about 4 ft. of water at low tide, and as it was necessary to locate the sewer extension above high tide, the problem involved the adopting of a type of construction which could be installed without interfering with the remainder of the work and at the same time provide for the proper handling of the discharge from the two city sewers. Having determined to support the new sewer on a pile trestle at the elevation of high tide, it then remained to select a suitable type of sewer. To this end consideration was given to the use of monolithic concrete, but on account of the possible action of salt water to which the concrete would be exposed, it was decided to use pre-cast concrete.



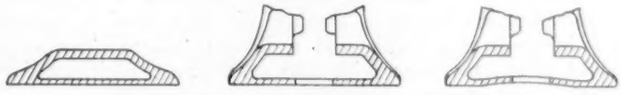
Something Different in Pre-cast Concrete Pipe—Details of One of the Pipe

As shown in the accompanying drawing, the pipe was furnished in 8-ft. tongue and groove sections, 7 ft. 2 in. high and 7 ft. 2 in. wide over all with a flat trough; the flat floor having been adopted to insure the maximum stability of construction. Each section weighed 17,800 lb., as a result of which a rather difficult problem in handling presented itself. The new fill on which the Lehigh Valley yard will be laid will bury the pipe to a depth of about 6 ft.

This pipe was made by the Massey Concrete Products Corporation at its Newark, N. J., plant, according to a design worked out under the direction of F. E. Schall, bridge engineer of the Lehigh Valley. The work of installing the pipe was handled by Henry Steers, Inc., New York.

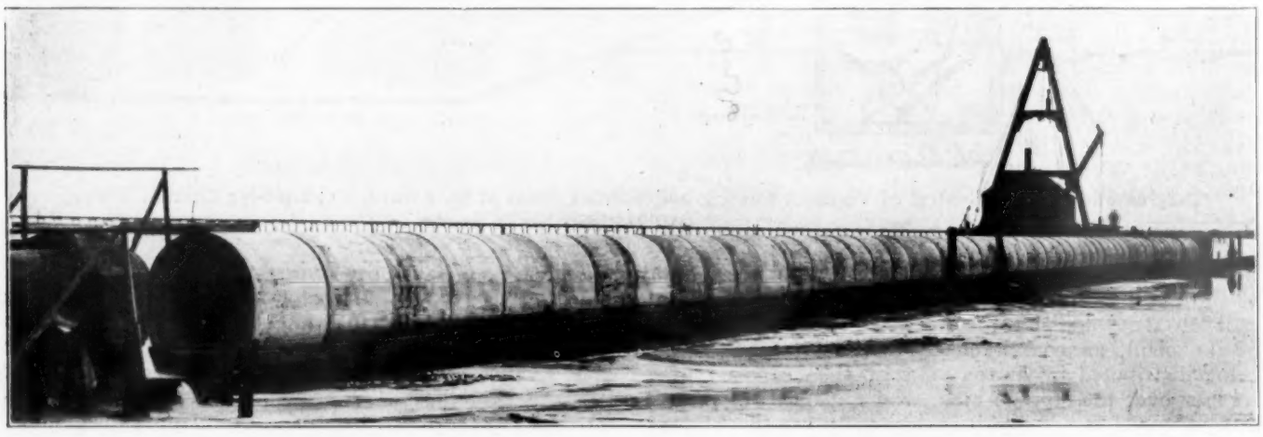
A New Form of Track Jack Base

THAT THE CONSTRUCTION of the base of a track is a detail which often has a marked influence upon the utility of such a tool in performing track work is well known by officers who have occasion to use such equipment or who have had such work under their charge. Particularly is the tendency of the base of any jack to bend a defect of consequence. Such a jack is a source of more or less danger on the one hand by reason of tendency to kick out from under its load and on the other hand it often gives rise to trouble in lining track by reason of the tendency of the jack to cant and otherwise fail to hold its proper position. In view of this it is of interest to note the development which has been made by the Templeton Kenly Company, Chicago, in the construction of the base of its Simplex track jack.



Cross-Sectional Views of the Jack Base

The construction is shown in the accompanying illustration, the drawing at the left being a section through the toe of the jack and that in the middle a cross-section through the center. As noted, the feature of this base lies in the cored or hollow construction, as distinguished from a solid section. Aside from furnishing a stable support for the load, this base was constructed primarily to overcome bending, and thereby to eliminate the troubles that arise from bent bases while in use and the damage that freqeuntly arises from fractures by repeated efforts to straighten bases which have bent while in service. The fact that the metal in the base is thin is also claimed to be an advantage on the hypothesis that a heavier section of metal in the base than in the standard often gives rise to stresses and strains during cooling or annealing of the casting which result in weakness. Furthermore, as the base is malleable, it adapts itself to the line of pressure, and ultimately assumes a concave base surface under service, thus transmitting the burden of the load to the rim. This feature is shown in the illustration at the right, which represents the base of the jack after the pressure has produced a permanent set.



The Pre-Cast Sewer Extension in Process of Construction